THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXIV. No. 861.] LONDON, NOVEMBER 11, 1879. [31ST YEAR.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

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LONDON DEPÔT:
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OFFICES:
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And SPECIAL GASOMETER PAINT.
SEVERAL PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.
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Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and other OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
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TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
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Roofs, Girders, and Bridges, and General Smith's Work.
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THE
"OTTO" GAS-ENGINE.

See Page 730.

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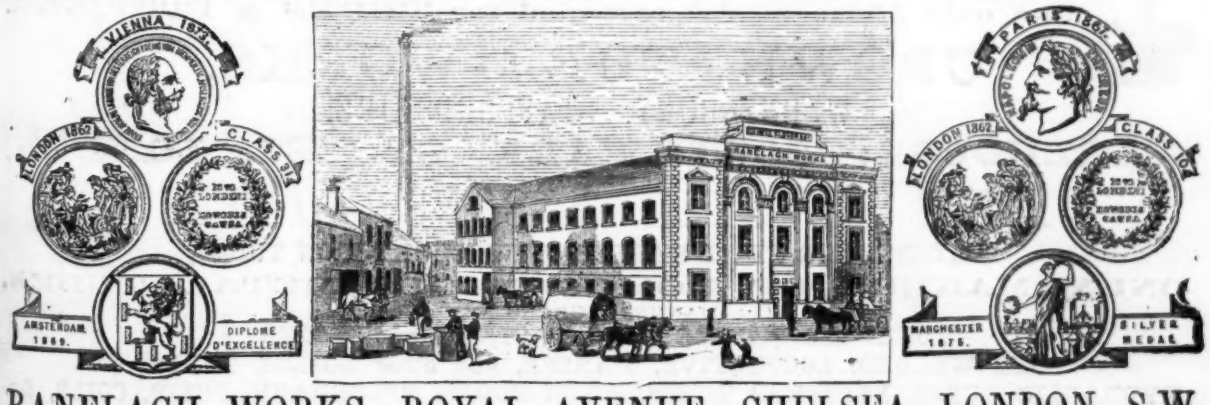
DRY GAS-METER MANUFACTURERS,

HAVE REMOVED TO MORE EXTENSIVE PREMISES:



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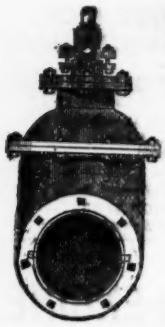
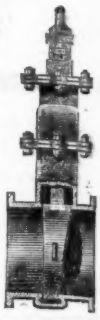
GAS, STEAM, AND HYDRAULIC TUBES AND FITTINGS.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

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EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

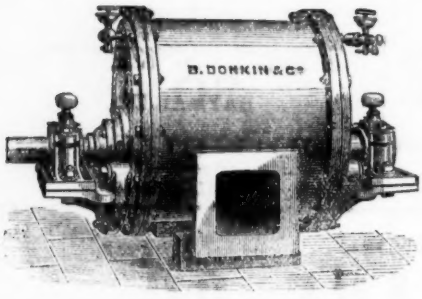
Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.



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NEW PATENT GAS-EXHAUSTERS,

For the Manufacture of which

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POSSESS THE SOLE RIGHT.

Made with two Outside Bearings and with all the Latest Improvements.

FULL PARTICULARS ON APPLICATION.

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THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

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GAS-FITTERS TOOLS. VALVES. COCKS, &c.

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(Established 1822,)

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AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN,

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—**The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.**

GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

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GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

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WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

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STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

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GAS PURIFICATION & CHEMICAL Co., LIMITED,
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Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

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ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

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ORLANDO BROTHERS, LIMITED,
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AND EVERY DESCRIPTION OF

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FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

THE FARNLEY IRON COMPANY, LIMITED,
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MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,
Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.

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GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.
MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM; AND 85, SOUTHWARK ST., LONDON, S.E.

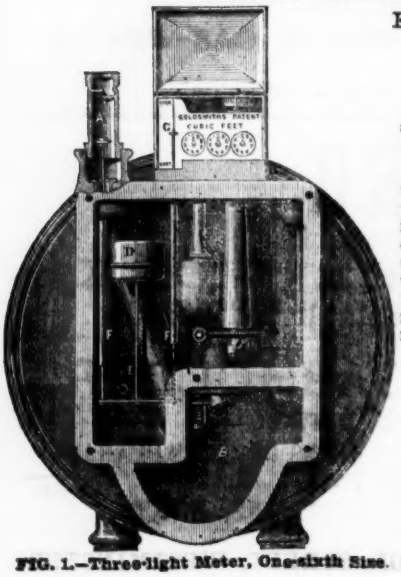


FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

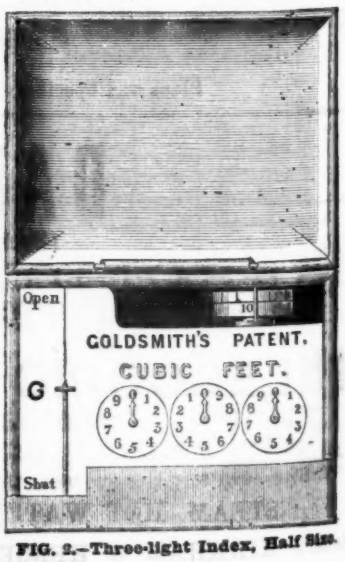
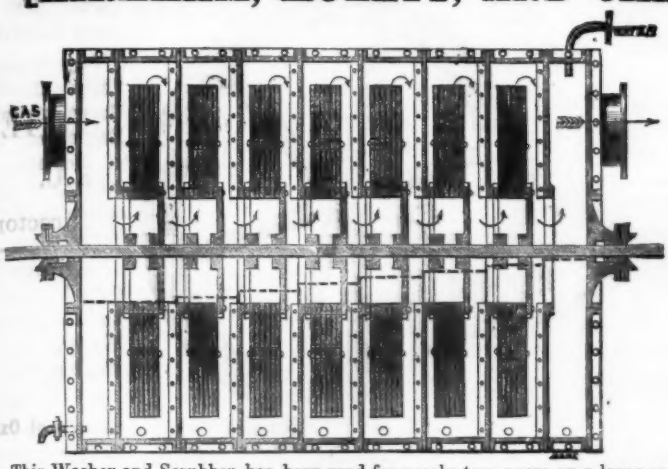
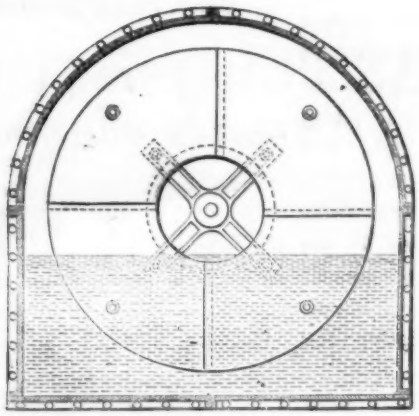


FIG. 2.—Three-light Index, Half Size.

THE "STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]





This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

D. HULETT, Esq. *The Gaslight and Coke Company, Bromley-by-Bow, May 3, 1877.*

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Leeds Corporation Gas-Works, York Street, Leeds, Dec. 6, 1878.*

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber,** so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan. 14, 1879.*

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, it takes **out every particle of Ammonia,** while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c. (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmospheres.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6⅜	5	3½	2½	1½	⅜	⅛	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
„ 2	8⅜	7	6	4⅛	3⅛	2¼	1⅛	⅜	⅛	0	10 „	57,000	Nil.	73°	66°	52°	21½	20½	4
„ 3	9⅛	8	6	3⅜	3	2⅛	1⅛	⅜	⅛	0	10 „	60,000	Nil.	75°	68°	40°	23½	22	4
„ 4	9⅛	7⅜	6⅛	4⅛	3⅛	2⅛	1⅛	⅜	⅛	0	10 „	65,000	Nil.	74°	68°	35°	24	23½	5
„ 5	9½	7	6	4	3	2⅛	1½	1	⅛	0	10 „	34,000	Nil.	77°	68°	35°	14½	14	5
„ 6	9⅛	7⅛	6⅛	4⅛	3	2⅛	1½	1	⅛	0	10 „	63,000	Nil.	72°	66°	27°	24	23½	4½
„ 7	11	9	7	5⅛	3⅜	3	1⅝	1½	⅛	0	10 „	59,000	Nil.	74°	66°	31°	25	23½	5
„ 8	9½	7⅛	6	4⅛	3	2	1	⅛	⅛	0	10 „	78,000	Nil.	73°	61°	31°	28	26½	4½
„ 9	11	9	7	5	3⅜	2½	1⅛	1	⅛	0	10 „	82,000	Nil.	74°	67°	33°	27½	25½	5
„ 10	10⅜	8½	6⅜	5	3½	2⅛	1½	1	⅛	0	10 „	66,000	Nil.	76°	64°	28°	28½	27	5
„ 11	12⅛	10	7⅜	5⅜	4⅛	3⅛	1⅝	1⅛	⅛	0	10 „	61,000	Nil.	73°	64°	27°	26½	25½	5
„ 12	11	8⅜	6⅜	—	—	—	1⅛	⅜	⅛	0	10 „	39,000	Nil.	74°	64°	27°	26½	25½	5
„ 13	13	10⅜	8⅛	6	4⅜	3⅛	2	1½	⅛	0	10 „	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May 23, 1879.*

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March 6, 1879.*

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				—	—	—	—	—	—	—	—	—	—	
60,000	Inlet	2·00	2·00	158·8	72	57	21	4	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·05	0·6	0·3	0·15	0·1	65
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

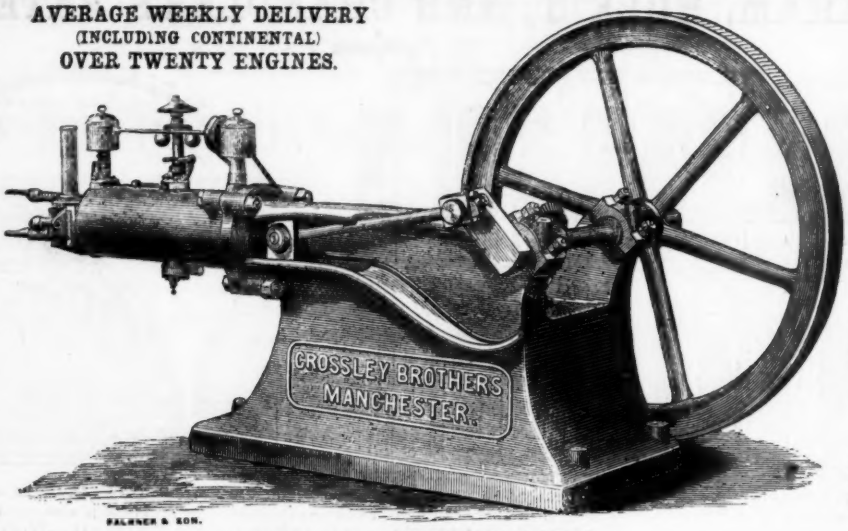
For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. SIZES { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } OFFERED. CASES NOT CHARGED IF RETURNED FREE.

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

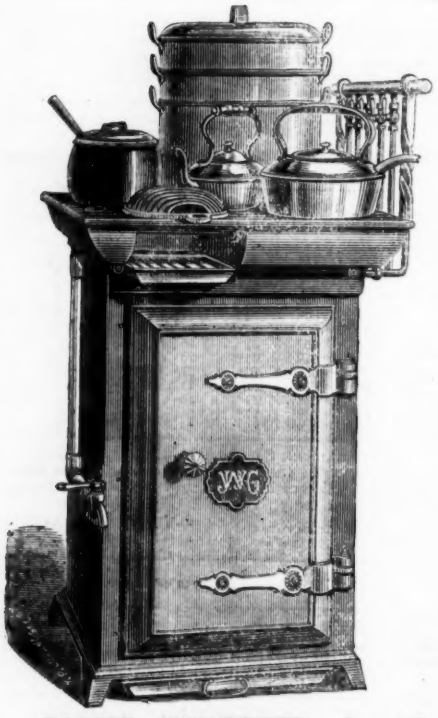
WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St.

CROSSLEY BROTHERS, MANCHESTER.

LONDON HOUSE: 116, Queen Victoria St., E.C.

THE NEW GAS COOKER.

40 PER CENT. OF GAS SAVED.



No. A510 same as our **No. A152,**
BUT LINED WITH PATENT NON-CONDUCTOR.
Will Roast, Bake, and Fry, and with Three Burners for Boiling.

SIZE.
Outside—30in. high, 20in. wide, 20in. deep.
Inside—19½in. „ 14in. „ 17in. „

Price . . . . . £4 14s. 6d.

No. A500.
LINED WITH PATENT NON-CONDUCTOR.
Is fitted with Roasting and Baking Oven and Four Burners for Boiling.

SIZE.
Outside—34in high, 20in. wide, 19in. deep.
Inside—30in. „ 16in. „ 17in. „
Hot Plate—24in. by 23in.

Price . . . . . £7 10s. 0d.

No. A505.
Same as with Roasting and Baking Oven, a Broiler or Toaster, a Chop Griller, a Hot Water Boiler, and Three Burners for Boiling.
Hot Plate—26in. by 24in.

Price . . . . . £9 15s. 0d.

These Cookers are jacketed, on the sides, top, and door, with a new and very efficient non-conducting material, by the use of which a **saving** of gas to the extent of **40 per cent.** is effected.

Gas Companies who are selling or hiring stoves should see these stoves. Catalogues and particulars on application to

JOHN WRIGHT & CO., ESSEX WORKS, BROAD STREET, BIRMINGHAM.

London Warehouses: { 155a, Upper Thames Street, / 1, Little Bush Lane.

TANGYE BROTHERS AND HOLMAN,

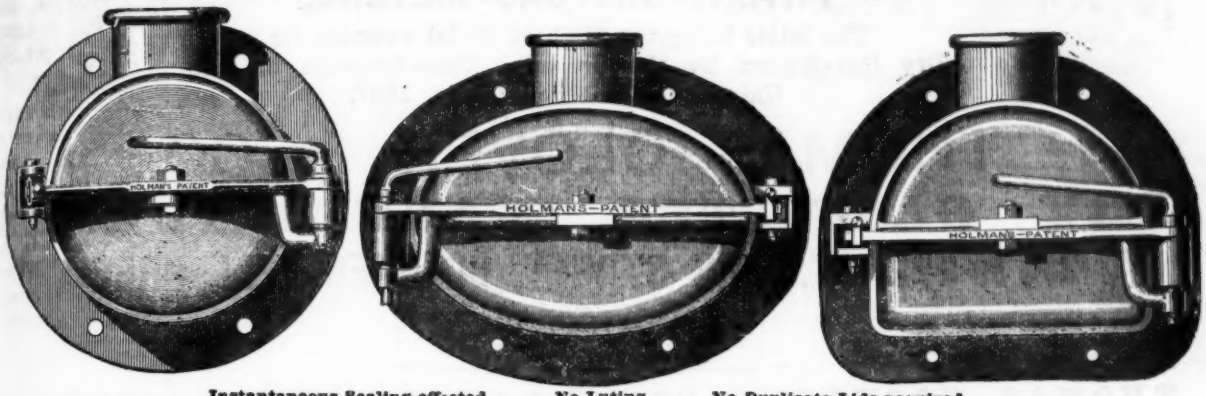
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

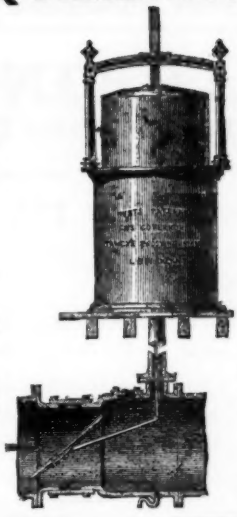
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hurt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

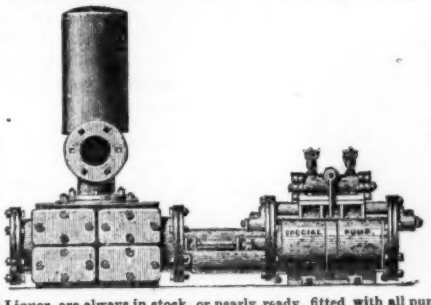
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1¼	9	450	£16
4	2	9	815	18
5*	2¼	12	1,250*	21
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

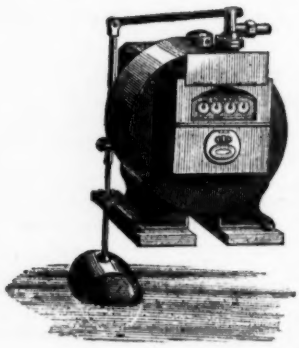
LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.

(ESTABLISHED 1816.)



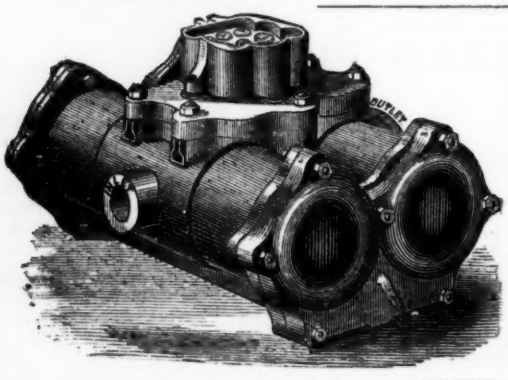
SOLE MAKERS OF THE LOW-PRESSURE WATER-METER.

This Meter will register with perfect accuracy, either at full speed, or with a few drops only passing through it.

It must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below.

Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



HIGH-PRESSURE WATER-METER.

The Union Water-Meter, of which an external view is here given, is of the positive class—*i.e.*, a Meter in which a measuring chamber is alternately filled and emptied, each filling being duly recorded. It is formed of two cylinders, with double pistons in each, having a rotary-valve of peculiar construction, which is worked from cams on the piston-rods.

It is claimed for this Meter, among its advantages over other Piston Meters in use, that it is extremely small and compact, and that its durability and accuracy have been proved by the fact that upwards of 20,000 of them, of various sizes, are in successful operation in the States. In England the instrument has been fully tested by several Water Engineers of eminence, and pronounced by them as a reliable and satisfactory register of water supply; it is also economical in cost.

ALL METERS are TESTED with 60 lbs. pressure before they are sent out.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

E. L.—*The Company are liable for the cost of re-making the roads, whatever time is allowed to elapse; but their responsibility for any accidents that may happen through imperfections in the roadway ceases at the end of twelve months.*

W. S. M'G.—*Thanks for sending copy of the letter. It had previously been brought to our notice, but it was determined not to call attention to it in the* JOURNAL.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 11, 1879.

Circular to Gas Companies.

THE evidences of a revival in the coal and iron trades are now unmistakeable, and glad as we are to witness increased activity in business, it remains to be said that the improvement in a general sense bodes no good to Gas Companies. Those who have long contracts for coals, may stand out and await events; but those with short contracts must put up with the inevitable consequences of a rise in price. This, for the present, will not be great; but we have to look forward, and are bound to say that the prospects of our industry may be somewhat compromised by the revival of trade. The low prices that have ruled for coal and iron during the past two years have enabled the Companies to make good profits out of gas, and at the same time to add to their plant at what may be called reasonable rates. This privilege now threatens to disappear. Coal and iron are going up in price and Gas Companies must make the best they can of the changed condition of things. In the North of England, and in Scotland, trade prospects are reported to be improving in almost every department of industry, and prices in the iron districts are coming to a normal rate. The chemical trades, which are of the utmost importance to Gas Companies, also show decided symptoms of revival, and this promises well for the sale of some of the residuals. Tar and ammoniacal liquor are likely to increase in value—a fact of which gas manufacturers may take note. It would be well, however, not to calculate too much on this revival, which so far promises a real success to the coal and iron industries, but which, as we have said, may land Gas Companies in some inconveniences. As a matter of course, all the works now in progress have been already contracted for, and any rise in the price of metal will not affect them; but, looking forward, we see a good time coming to most people. After all, a high charge for gas is not an unmitigated evil; and we must caution Companies to stand out in future sessions of Parliament for a full initial price.

We have referred to a rise in the price of coals, which may greatly influence the prosperity of Gas Companies. It will be seen, from what appears in another column, that Parliament now cuts down to the lowest possible limits the initial price of gas, when the sliding scale is imposed, so that a rise of dividend is almost impossible. This is an important feature in recent legislation, which we hope will be modified next session. A fair margin should be allowed. It will not do to say that, because a Company have supplied gas at a certain rate, their initial price shall be fixed according to that amount. Various contingencies must be taken into consideration, and among these a rise in the price of coal must be regarded as of the utmost importance. It may not immediately tell on our industry; but, supposing the improvement in trade to continue, the cost of coal will soon reach what it was in 1873-74, when the Chartered and Imperial Companies applied for a revision of prices.

We learn that notice has been given that the price of gas to consumers in the late Surrey Company's district has been reduced to 3s. per thousand feet, from the commencement of the present half year. This will make the price level all over the district of the United Company. The drop of ninepence per thousand feet might appear a serious matter. It looks like a diminution of income of something like £15,000 per annum; but the circumstances of the United Company perfectly justify the reduction, and we feel confident that the present dividends will be retained, if not increased. Perhaps no happier combination has ever been arranged than that of the South Metropolitan and the Surrey Gas Companies. It has resulted at once in a reduction of one-fifth in the price of the gas supplied to the consumers in the district of the latter Company, and the profits realized are likely to materially augment the prosperity of the United Company. We look forward with pleasurable anticipations to future amalgamations, which are certain to further increase the power and prosperity of the Companies who may combine. The Companies in South London want homogeneity of constitution, and, that established, all is certain to go well.

All attempts at improvements in street lighting must be regarded with favour, and among these we may mention Collins's patent reflector, which is now being exhibited at the lower end of St. James's Street, Piccadilly. The object of this reflector is to receive, as near as possible to their source, all the rays otherwise wasted in useless directions, and by reflecting or breaking them up, by means of planes arranged at varying angles, to utilize their maximum intensity in the direction required. This is effected by mirror surfaces of high reflecting power, placed in such positions respecting the flame, as to divert to the part requiring to be illuminated the intensity of all wasted rays. We are bound to say that if the lamp placed at the Pall Mall end of St. James's Street is a fair sample of Collins's reflectors, they deserve attention. We have had several exhibitions of reflectors in the streets, but nothing approaching this in effect. The failures, however, need not be here enumerated. We leave the Collins system of street lighting to the appreciation of public bodies and gas consumers in general.

An extraordinary meeting of the Bristol United Gaslight Company was held last Wednesday, to authorize the raising of £100,000 of new capital, and the exercise of the borrowing powers by the issuing of debentures to the usual amount of one-quarter of the new capital. It would seem that this capital is not all required immediately, but the Directors have taken a wise course in providing for the future, and so saving the necessity of repeated applications to the Shareholders. A rather foolish desire was evinced by one of the gentlemen present for extravagant interest on the debentures, but this was promptly laughed down. The Companies Clauses Act, 1863, under which the issue takes place, only allows on debenture stock interest at the rate of four per cent., and the Proprietors of gas shares must make up their minds to accept this limitation. The reverend gentleman who wished

for six or seven per cent. on debentures must be content to put up with the interest named by the Legislature.

We publish in another column the gas accounts of the Corporation of Aberdeen, which show that in the past year a net profit of £8021 has been earned, which is applicable to the payment of annuities, interest, &c. The amount realized from the sale of gas and by meter-rents during the past year was £44,066, and residual products brought—coke £482, and tar and ammoniacal liquor £3748. Against these items has to be set the cost of cannel, which amounted to £25,064. The state of the undertaking is, to our mind, eminently satisfactory, as it will be seen that no profit has been made available for application to public improvements. The consumers have the full benefit of the profits in the price of gas, which is fixed by annual estimates.

We invite the attention of those of our readers who have time to devote to literature, to the list of subjects put forward by the Council of the Institution of Civil Engineers, on which approved essays will be entitled to premiums. A very useful paper may be written on the "Principles underlying the "Progress of Economy in Gas Production and Distribution, "with recent Methods of Purification." We have not yet reached the last stage of economy in gas production, and it will be well to have fully explained the principles which guide us in our efforts to reduce expenses and increase production. Regenerative furnaces, we may take it, will form an important feature in the discussion of this matter, for among the chief principles must be reckoned the economic application of heat for distillation. Mechanical stoking will necessarily occupy attention, and a good description of recent methods of purification will be a valuable addition, for but little is known of some of these, which are only in use at a few works. In treating of the "Relative Advantages of Steam, Heated Air, "Gas, Water, and Electricity, as the Motive Power in small "Engines," we are satisfied that preference will be given to gas, as the cheapest and most manageable agent that can be employed. It will be seen that the other subjects on which contributions are invited are of an eminently practical character, and we hope that the invitation of the Council of the Institution will bring forth a number of useful essays which the gas world will well appreciate.

An eminent French physicist has published his views of the effects of different illuminants on the human organism. Strange to say, he gives the preference to tallow dips, as affording the most harmless means of lighting up a room. The use of petroleum oil is condemned, but only on account of the various accidents which have occurred. Colza or rape oil he considers much safer, but admits that petroleum will predominate, on account of its low price. Gas is not condemned, except for use in close rooms. Where a full supply of air can be obtained, gas, he thinks, will reign supreme, notwithstanding the rivalry of the electric light, which is objected to on account of the intensity and colour of the light. M. Bouchardat rightly thinks that this light is not likely to come into general use for a long time yet. While on this matter, we may mention that a series of comparative experiments are being made at the Palais de l'Industrie, Paris, between the Siemens and Lontin lights, in order to ascertain their relative value as illuminants, and the cost of the production of the light. In the meantime, it may be noted that the use of the electric light has been discontinued at the Albert Hall, where gas once more affords a cheerful radiance and a genial warmth. We feel satisfied that wherever electricity is experimented with, its employment will be only temporary. For street lighting we cannot deny that it may have some advantages, but we believe that these will be altogether outweighed by the cost of the light.

We commence in another column our annual *résumé* of the Gas Acts which have passed the Legislature during the recent session of Parliament. We confess to a preference for direct statutory authority rather than that conferred by the confirmation of a Provisional Order by a General Act. It will be seen that only five Companies succeeded in obtaining parliamentary authorization for their undertakings, and that the majority of them have auction clauses and the sliding scale imposed upon them, which may not be a grievance if a good initial price be allowed. The Houghton-le-Spring Gas Company escaped these enactments by virtue of being a new Company, and therefore entitled to the consideration of the Legislature. The Westgate-on-Sea Gas and Water Bill was rejected, so far as the gas portion of it was concerned, in consequence of a statement being made that Westgate lay within the limits of the Isle of Thanet Gas Company. The truth of this statement is now being put to a practical test, for the proprietor of the Westgate Estate has cut the main which the Company had laid through his property. The decision in this case will be of interest to Gas Companies, inasmuch as it will show them the rights they possess to lay mains through *quasi*-private property. The case is still before the Chancery Division of the High Court of Justice, so we must not further allude to it.

Water and Sanitary Notes.

We are happy to say that, in accordance with our wishes, but contrary to our expectations, the ratepayers of Liverpool have decided in favour of the Vyrnwy water supply scheme. Perhaps it was fortunate that the poll was taken so near the time of the municipal elections. The Town Council of Liverpool are Liberal in their tendencies, and there is a majority of that party on the Water Committee. Thus everything was prepared for success, and the only doubt existing in our mind was, whether or not the probable expense of the scheme would frighten the ratepayers. The Water Committee will now proceed with the Bill which, no doubt, they have ready to launch. It will have to encounter great opposition from all interested in the River Severn, from its head waters to Worcester, and a long parliamentary contest must be anticipated. In the event, we hope and expect that Liverpool will triumph, for we are certain that nothing will be asked for which will be injurious to the interests of any persons concerned with the Severn waters. The majority obtained by the Water Committee on the poll of the ratepayers was very pronounced, being nearly 3000.

We do not care to drink dirty water, but we have never believed such disastrous results ensued from its imbibition as are alleged by enthusiastic sanitarians. Dr. Emmerich, of Munich, has, according to our contemporary, the *Analyst*, put the matter to a practical test. He has indulged in water obtained from a ditch, fed *inter alia* by drains and privies, seasoned by the contents of dirt-carts, and the carcases of dead animals. The Doctor rejoices in excellent health, and considers himself rather better than otherwise. He subsequently prescribed the dirty mixture for a dyspeptic patient, who speedily recovered under the nasty *régime;* so henceforth the filthiest sewer mixture must be considered as a necessary adjunct to the therapeutic agents in the Pharmacopœia. We know very well that such experiments have been made. It has been alleged that cholera stools, if imbibed, will reproduce the disease; but, if our memory serves us, a French physician drank a litre of rice water evacuations, and was none the worse for the disgusting dose. While in all cases protesting against the prejudices of consuming water but slightly contaminated with organic matter, such as that obtained from the Tees for the use of Stockton and Middlesbrough, and from the Calder for Wakefield, we must confess our preference for a supply of water which shall be as free as possible from organic pollution.

The inhabitants of Aberystwith are anxious to obtain an additional water supply, and have set their affections upon a lake in the Plinlimmon range of hills. This would, no doubt, answer their purpose perfectly if the waters were not required for washing lead and the *débris* of other mineral workings, and, therefore, likely to bring down a solution of oxide of lead. The distance of the lake from the town is sixteen miles, and it lies at an elevation of four hundred feet. To counteract the enormous pressure which would result from this elevation, it is proposed to fix three pressure-reducing arrangements in cisterns. The first to be placed one mile and five furlongs from the lake, the second seven miles and three furlongs, and the third eight miles and half a furlong. The cost of the proposed site is estimated at £16,816, but the total estimate for the new works is £23,104. Last week an inquiry was held by an Inspector from the Local Government Board, at which it transpired that the water was required for Crown purposes, and the Inspector (Major Tulloch, R.E.) was of opinion that a supply of water could be obtained much nearer than sixteen miles from Aberystwith. But, as the inquiry was adjourned, we must leave the matter for the present.

The Water Committee of Leeds have been rejoicing over the completion of their Fewston reservoir, and on the Monday of last week the Mayor unlocked the valves with a golden key, and afterwards wound up the sluices. The reservoir was not then full, there being only twenty-seven feet of water in it, while there is intended to be forty-seven feet. Water in Leeds is now exceedingly cheap, so much so that it is said that a man may have a ton of it conveyed to his house for three-farthings. By-and-by it may not be so cheap, but, in any case, Leeds is certain, for all time to come, to have an ample supply of water. The Eccup reservoir just commenced will hold enough water to furnish a supply for six months to

the present population, so that there is no chance of a drought. Leeds grows, but it will be long years before the wants of the inhabitants can overtake the capacity of the reservoirs.

Dr. Tidy's report on the composition of the Metropolitan waters for the month of October is highly satisfactory. As regards total solid matter, the Kent water stands the highest, but, of course, the mineral ingredients are perfectly harmless. The waters of the Thames and New River Companies, which stand next as regards what is called purity, are nevertheless perfectly free from any deleterious matter, and are reported as having been clear and nearly colourless. After the water which Dr. Emmerich tasted at Munich, and found to be perfectly wholesome, Thames water must be considered a perfect luxury in respect of purity.

The inquiry into the sanitary condition of Dublin has been closed, and little was discovered which was not well known before. We have again and again referred to the condition of the sewerage of the city, and to the state of the Liffey; but little notice has been taken of the sanitary wants of the inhabitants. Dr. Quinlan, in his recent address at the opening of the Session at St. Vincent's Hospital School, alluded to a subject of a very important character—namely, the city's abnormal death-rate. Although he did not tell us anything new concerning the state of the city, yet his address was fresh and interesting. The private system of drainage and ash-removal, he believes to be entirely blameable, but we cannot help thinking that something more than this affects the high death-rate in Dublin.

The Corporation of Maidstone are exercised on the subject of their drainage works, the cost of which is calculated to exceed the estimate made for their construction. It would appear that up to this time but few connections have been made from houses into the sewers. Great complaints are heard of want of effective ventilation of the sewers, it being alleged that two cases of typhoid fever have been caused by emanations of sewer gases from the ventilators. Happily neither resulted in the death of the patient, and we may conclude that, apart from the noxiousness of the odour which escapes, nothing serious resulted. Maidstone, we presume, will presently finish its sewerage system, and whether the effluent be discharged into the Medway, or the sewage be chemically treated, as recommended by Mr. Angell, or turned upon land for irrigation, the best results may be hoped from the steps taken, whichever scheme may be employed.

A discussion has just arisen as to the value of the so-called disinfectants as now commonly employed. We allude here mainly to carbolic acid and to what is called "Sanitas"—a aterial which was recently described in these columns as a weak solution of peroxide of hydrogen associated with turpentine. Peroxide of hydrogen is a most powerful disinfecting agent, but what amount is to be found in "Sanitas" we do not know. Condy's fluid contains perhaps the best reservoir of peroxide of hydrogen, and its use cannot be too strongly recommended. "Sanitas" has, however, its value, mainly for immediate use, but we have a suspicion that the peroxide of hydrogen which it undoubtedly contains in considerable quantities when first made, will not be retained. The Corporation of Blackburn may, therefore, be perfectly safe in the use of this disinfectant, always supposing that they get it fresh and new. We cannot here make any statement as to the rate at which "Sanitas" loses its disinfecting power; but the opinion may be strongly expressed that to be effectively used it must be fresh from the factory.

The Electric Light, which was used last winter for the illumination of the Albert Hall on grand concert nights, and which was said to be such an unqualified success, has been discontinued; and, on Thursday, at the opening performance for the present season of the Royal Albert Hall Choral Society, gas was again used for the lighting of this vast interior.

The *Journal des Usines à Gaz* states that M. Jordan, Professor at the Ecole Centrale, Paris, Past-President of the Society of Civil Engineers, and President of the Société Technique de l'Industrie du Gaz en France, who is at present an officer of the Legion of Honour, has just been made a Chevalier of the Swedish Order of the Polar Star.

In consequence of the amalgamation of the Surrey Consumers Gas Company with the South Metropolitan Company, the arrangements for which are now completed, the price of gas throughout the late Surrey Company's district has, from the commencement of the present half year, been reduced to 3s. per 1000 feet. This will entitle the holders of B capital in the United Company to receive a dividend of 11 per cent.

At the meeting of the Metropolitan Board of Works last Friday, it was referred to the Special Purposes and Sanitary Committee to consider as to the insertion of the necessary notices preliminary to the introduction of a Bill to amend the Chartered Gas Company's Act of 1876, in respect to the penalty to be imposed in the event of the supplying of gas of deficient illuminating power, authority being given to the Committee to issue the notices if they thought fit. It was stated that the Committee will to-morrow have an interview with the Committee appointed by the City Corporation upon the same matter.

GAS LEGISLATION FOR 1879.

Of the six Companies who applied to Parliament during last session to be incorporated with statutory powers, five succeeded in obtaining the object of their wishes. The sixth failed by what may be called a side issue, which is now the subject of legal investigation. The Acts passed were as under:—

The *Houghton-le-Spring Gas Act* incorporates a Company for the supply of gas to Houghton-le-Spring, Newbottle, and East Rainton. The amount of capital authorized is £20,000, and power is given to borrow £5000, the rate of interest on which is not to exceed five per cent. In this case the Standing Orders were so far suspended that neither sliding scale nor auction clauses are enacted; so the dividend payable will be regulated by the General Acts, and be limited to ten per cent. Gas of fourteen-candle illuminating power is to be supplied, but nothing is said about purity. The pressure at which the gas is to be furnished is that which is now usually prescribed—viz., six-tenths of an inch from midnight to sunset, and eight-tenths from sunset to midnight. The maximum price for gas in Houghton-le-Spring is fixed at 4s. per thousand feet, and 5s. in Newbottle and East Rainton. On the whole, the Company have succeeded well in Parliament. They went for a 5s. maximum in Houghton-le-Spring and 5s. 6d. beyond, so that the terms granted cannot be considered illiberal.

The *Knutsford Light and Water Act* dissolves and reincorporates the Knutsford Gas and Water Company, and, so far as gas supply is concerned, authorizes them, with a present capital for that purpose of £11,000, which is to be converted into stock, to raise an additional £20,000 in £10 shares, with power to borrow £2500 on the original, and £5000 on the additional capital. The dividends on the new capital are limited to seven or six per cent., according as it is raised as ordinary or preference. Auction clauses and sliding scale are inserted; but the latter has been somewhat modified from what the Bill proposed (see Vol. XXXIII., p. 189), and the initial price is now fixed, regardless of total annual consumption, at 4s. 6d. per thousand feet. The gas furnished is to have an illuminating power of fourteen candles, tested by Sugg's No. 1 "London" Argand burner. A testing-place is within twelve months to be established upon or within two hundred yards of the works. The pressure at which the gas is to be supplied is that which is commonly prescribed—viz., six and eight tenths of an inch, within the usual hours.

The *Morecambe Gas Act* dissolves and reincorporates the Morecambe Gaslight Company, hitherto carried on as a Limited Liability Company. The Company was started in 1858, with a capital of £2000 in £5 shares; but additions have been made on several occasions, so that the original capital had reached to the sum of £24,000. By this Act, however, the amount of the original capital is reduced to £20,000, and power is given to raise an additional £16,000. It is prescribed that £12,000 of the original capital shall be converted into stock, and the remaining £8000 thereof shall be divided into 800 shares of £10 each. These old shares will, of course, be entitled, subject to the sliding scale, to ten per cent., but the dividends on the £16,000 new capital will be limited to seven per cent. if issued as ordinary, and six per cent. if as preference shares, subject to the sliding scale. These shares are, as a matter of course, to be offered by public auction or tender. Power is given to borrow £5000 on the original, and to the usual extent on the additional capital. Gas of fourteen-candle illuminating power is to be supplied, tested by Sugg's "London" Argand, No. 1. Subject to the sliding scale, the standard price which may be charged for gas is 5s. per thousand feet. The Company may manufacture, purchase, sell, or let on hire all kinds of apparatus for the utilization of gas for other than illuminating purposes, the charge for which is to be settled by agreement. The Act further authorizes the construction of a siding and a junction with the railway. Beyond this the Act makes all necessary provision for the transfer of the undertaking of the Limited Company to the Incorporated Company, with all rights and liabilities. The limit of the Act includes the town of Morecambe and several surrounding townships and parishes. In one part of the district the Company come in collision with the Lancaster Gas Company, but it seems that any differences can easily be arranged.

The *Queenstown Gas Act* dissolves and reincorporates the Queenstown Gas Company, Limited, which was started in 1856 with a nominal capital of £10,000, of which £9000 has been paid up. The Company, however, meantime, have expended on works money to the amount of £3089 out of profits. By this Act the capital of the Company is fixed at £25,000, which is to

be classified as follows:—The original capital of £10,000 is to be divided into 1000 shares of £10 each, to be called A shares. Expended profits, amounting to £3089, are to be converted into £10 shares, to be called B shares, which are to be divided rateably among existing Proprietors. Then, by the powers given by this Act, additional capital to the amount of £12,000 may be raised. This capital is to be disposed of by auction or tender in the usual way. In respect of the original capital, the Company have power to borrow on mortgage the sum of £10,000, and, in respect of additional capital, any sum not exceeding £5000, inclusive of the mortgage debt of the old Company, amounting to £4600. All borrowed money, if converted into capital, will be entitled to only five per cent. dividend. Gas of fourteen-candle power is to be supplied, tested by Sugg's "London" Argand, No. 1. The maximum price is not to exceed 6s. 6d. per thousand feet. The sliding scale is not prescribed, probably because the Act contemplates the speedy transfer of the undertaking to the Improvement Commissioners of Queenstown. This is provided for by section 69, which enacts that within two years of the passing of the Act the Town Commissioners may purchase the undertaking by arbitration; but it is provided that in assessing the value, the Arbitrator shall not take into consideration the fact that the Company are now incorporated by statute. In the meantime, the Commissioners have power to appoint an Auditor, who is to examine the accounts of the Company.

The *Wisbech Gas Act* dissolves and reincorporates the Wisbech Gas Company, Limited, started in 1858 with a nominal capital of £10,000; but additions to the works have been made out of revenue, and this Act fixes the original capital at £15,000, in capital stock deemed to be fully paid up. In addition to the before-mentioned original capital, the Company may raise the further sum of £8000. The loan capital of the Limited Company appears to amount to £3750, and, in addition to this, power is given to raise loans on the additional capital to the usual extent of one-fourth. Subject to the sliding scale, the dividend of the new capital is limited to seven or six per cent., according as it is raised. Gas of fourteen-candle power is to be supplied, tested by Sugg's "London" Argand, No. 1. The standard price to be charged by the Company is to be 4s. 6d. per thousand cubic feet, subject to the sliding scale. The new shares, or stock, are, of course, to be sold by auction or tender, the premiums being employed as usual. It is provided that the whole nominal amount, together with any premiums, shall be paid to the Company within three months after such sale. Beyond this the Act confers upon the new Company all the powers usually granted to a statutory undertaking.

Phœnix Gaslight and Coke Company.—Last Wednesday, an extraordinary meeting of this Company was held at the office, Bankside, for the purpose of making a call of 10 per cent. upon the new stock of the Company, payable on the 1st prox.

Limerick Water Supply.—An arbitration was opened on Tuesday, the 28th ult., as to the quality of the water supplied by the Limerick Water-Works Company, and was continued day by day until last Tuesday. Mr. John Ayris, Engineer of the City of Norwich Water-Works Company, was the Arbitrator appointed by the Company; and Mr. William Spillane, J.P., by the Corporation; while Mr. Edward Murphy, J.P., was the Umpire.

Curtailment of Public Lighting at Abersychan.—At the last monthly meeting of the Abersychan Local Board, it was resolved unanimously not to have the public lamps lighted for five or six nights during the full moon; and, by 7 votes to 5, that the lamps be extinguished at midnight. One of the local papers, in reference to the matter, says: "The determination of a small section of the Local Board to extinguish the public lamps at midnight has been carried into effect. We learn that several respectable tradesmen have already expressed their disapproval of the Board's new policy." Their correspondent, writing from Pontnewynydd, also says: "The gas-lamps in our streets have been turned into a new source of danger; instead of lighting the weary traveller on his way, they have been converted into real 'stumbling-blocks.' The next step our Local Board should take is the removal of these fixed and dangerous ornaments from the streets after twelve o'clock."

Liverpool Engineering Society.—The usual fortnightly meeting of this Society was held last Wednesday—Mr. M. E. Yeatman, M.A., President, in the chair—when a paper entitled "Notes on Sewers and Sewage" was read by Mr. E. H. Allies, Member of the Association of Municipal and Sanitary Engineers and Surveyors. The Author divided his subject into four parts:—1. Drainage works, both ancient and modern; 2. The sewer in its relation to public health; 3. The form, construction, and ventilation of sewers; and 4. The disposal of sewage. After glancing at the construction of sewers by the Romans and others down to our times, he went on to show how great an effect the sewer had on public health, and how important it is that work of this description should be properly designed, carried out, and kept in repair. He treated at considerable length on the ventilation of sewers, and the various methods proposed from time to time for effecting this object, advocating the system of open grid ventilators at frequent intervals, and condemning the use of charcoal in lever ventilators. In conclusion, he referred to the disposal of sewage, and showed how the difficulty of dealing with this part of the question has increased of late years. He did not believe in any of the chemical treatments of sewage being made to pay at present, in proof of which he stated that at least 19-20ths of the sewage of Great Britain was thrown away. He advocated agricultural irrigation as the least expensive mode of disposing of town sewage when there is no direct outlet to the sea, and gave the area required for this purpose per head of population.

THE ARBITRATION ON THE THAMES SEWAGE OUTFALLS.

This morning the proceedings in the arbitration case between the Thames Conservators and the Metropolitan Board of Works, which, as previously stated would be the case, commenced last week, will be resumed before Sir C. Hartley, Mr. F. J. Bramwell, and Captain Galton, at the Surveyors Institute, Westminster. On the side of the Conservators the counsel consist of Mr. Pope, Q.C., and Mr. Aston, Q.C. The Metropolitan Board are represented by Mr. Bidder, Q.C., Mr. Michael, Q.C., and Mr. Edward Clarke. The manner in which the case for the Conservators is to be set forth was pretty fully shown by Mr. Pope in his opening address las Tuesday. As the question at issue is now *sub judice*, and the evidence is as yet very incomplete, we can only refer to the subject within certain obvious limits. That which fairly invites discussion at the present stage is the avowed basis on which the case for the Conservators is to be conducted. Thus we observe that, according to the statement of Mr. Pope, the issue raised by the Conservators is limited to three particular mud-banks in the vicinity of the sewage outfalls. The proceedings are taken under the 20th and 21st sections of the Thames Navigation Act of 1870. The first of these sections requires that "the Metropolitan Board shall, at their own "expense, keep the Thames free from such banks, or other "obstructions to the navigation thereof, as may have arisen "or may arise from the flow of sewage at their outfalls for "the time being into the river." Mr. Pope contended in his argument that the law did not merely cast upon the Metropolitan Board the duty of removing mud-banks caused by the outfalls when it was shown that these banks were "obstructions to the navigation" according to the experience of persons navigating the Thames. The fact that the mud-banks were there was sufficient to bring them within the scope of the Act of Parliament, presuming that they were actually caused by the sewage outfalls. The law, said Mr. Pope, "assumes that banks in the river are obstructions to "the navigation." Let it be shown that banks exist which are caused by the sewage outfalls, and the Metropolitan Board are under legal obligation to remove them.

It will be seen that the case for the Conservators is thus materially simplified, and at the same time considerably narrowed. If this be the whole issue that is to be tried, a great part of Captain Calver's report goes to the winds. It also casts aside the statements of Mr. Leach, the Engineer to the Conservators, that sewage mud transported from the outfalls is to be found forming banks as high up the river as St. Thomas's Hospital and Chelsea. Still, we find Mr. Leach giving evidence to that effect in the present inquiry, and it will be very difficult to keep it altogether in the background. Mr. Pope quoted from a letter addressed to the Metropolitan Board by Captain Burstal in 1877, in the course of which it was stated: "Besides the deposits of sewage mud which occur "near the outfalls, deposits identical in character and more "prejudicial to the navigation are met with in the river "higher up." If so, it would seem that these ought to be removed as well as those lower down. But Mr. Pope apparently feels that there would be more difficulty in proving his case with regard to these mud-banks than there would be with respect to those in the vicinity of the outfalls. Hence he limits the scope of the inquiry, and says, referring to the three shoals near Barking and Crossness, "I shall ask "the Arbitrators to report that these three banks have been "caused by the discharge of the sewage at the northern and "southern outfalls."

If the Conservators and the Metropolitan Board were to fight over all the mud-banks which have been alleged to stand connected with the main drainage works, the war would be one of considerable duration. Supposing Captain Calver's report to be taken as absolute evidence, there is scarcely a mud-bank anywhere in the Thames for which the outfalls are not more or less responsible. "The superior disturbing and "transporting power of the flood stream," associated as it is with that unfortunate attribute of London sewage which makes it "stick" during the ebb, and travel during the flood, necessarily has the effect of making the sewage appear where Sir Joseph Bazalgette never expected to see it. Mr. Pope referred to a statement that there was a sewage bank near the landing-stage at Erith, which could not only be seen, but smelt. It seems rather hard that sewage should thus go up the river and down the river—in fact, into every hole and corner it can find. The point is one which we feel somewhat free to discuss, because we quite understand that this universality of the sewage is not to be pleaded before the Arbitrators, despite the sensation which it has created. In

addition, all that relates to the mere pollution of the stream is out of court. Thus, something like three-fourths of Captain Calver's report is removed from the consideration of the present tribunal. The restriction is probably a wise one, for if it were shown that a close identity existed between mud at Westminster and mud in the neighbourhood of the outfall, it might be urged with considerable show of reason that the mud was in all cases the product of something other than sewage.

The disputants are apparently agreed that there is mud somewhere. The controversy is as to the origin of that mud. Mr. Keates and Captain Calver are on this point as wide asunder as the poles. Captain Calver gets his chemical evidence from Professor Williamson, supplemented by the recorded analyses of Dr. Letheby and others. Whether Captain Calver will be called as a witness before the Arbitrators appears doubtful. This gentleman is not in good health at the present time, and possibly his presence will be dispensed with. Professor Williamson will probably be called. Of the appearance of Mr. Keates there is no doubt. So far, the chemical evidence will get sifted, and if this is properly done we fancy a good many fallacies will drop out. One of a very remarkable kind has already attracted considerable attention. By a singular oversight, Captain Calver took as a standard sample of sewage-mud something which was essentially different, being nothing more nor less than the mud of the roadway, fetched up from a catchpit in Queen Victoria Street. Captain Calver asserts that the detritus of the Metropolitan thoroughfares finds its way through the outfalls into the Thames, there helping to form accumulations of mud. In this instance, Captain Calver seems to have caught the detritus at the wrong end; and, having done so, he has declared its chemical identity with the mud to be found in the Thames. When the mistake was pointed out by the officers of the Metropolitan Board, it was open to Captain Calver to contend that he had unwittingly proved the presence of road detritus in the river. But in that case he must have denied the presence of sewage, and he was not prepared to give up a position which he had so strongly maintained in his report. Hence he explained the matter by saying that "the identity I pointed out as existing between the two "substances depended neither upon the relative proportion "of their constituents, nor upon the percentage of organic "matter." Captain Calver says the identity claimed consisted in the "nature" of the constituents. We can only say that, if Captain Calver still adheres to the "identity" of the mud in Queen Victoria Street and Barking Reach, his presence in the witness-box could not be altogether unacceptable to the counsel for the Metropolitan Board.

As we have already intimated, road detritus in the Thames, if proved to come from the outfalls, would be sufficient to prove the case against the Metropolitan Board. Great care is taken to keep the street mud out of the sewers; and, after all, there are abundant data to show how much solid matter is to be found in a gallon of average London sewage. Some of Captain Calver's calculations cannot be accepted, but trustworthy data are not hard to find, and such will doubtless be laid before the Arbitrators. The composition of a mud-bank is a difficult point to settle, and Mr. Pope must be credited with having stated his case in a temperate and judicious manner. All his statements were clear, and some of them were forcible. The narrowing of the issue facilitates the inquiry and will lessen the expense. It is not asserted that the central navigable track of the Thames has been diminished in depth by the action of the outfalls. Captain Calver repudiates any such statement, and the Secretary and the Engineer to the Conservators agree with Captain Calver on that point. Mr. Rawlinson, on the occasion of the Barking inquiry, also arrived at the same conclusion. Neither, according to Captain Calver, is there any fear that the tide-way will be blocked in the future, for he says: "The action of the "land floods, and the frequent passing to and fro of the "steam traffic of the river, will always maintain a navigable "passage through its foul reaches."

But a mud-bank anywhere in the river is an obstruction, say the Conservators, and they are determined, if possible, that three particular banks shall be got out of the way. The cost of doing this will be some few thousands a year for dredging, and an unknown sum for land on which to deposit the dredged-up material. But dredging is not to be looked upon as a permanent remedy. Either the sewage must be deprived of its solid constituents before being cast into the river, or it must be carried off, through costly extension works, to some remote point where it will not offend anybody, if such point can be found. If the lesser remedy be adopted, and the solid constituents extracted, there will be another rock ahead, owing to the probability of an intolerable nuisance being created, in addition to which there will be the inevitable cost of getting rid of the residuum. But if every mud-bank created by the sewage outfalls is to be considered an obstruction to the navigation, whether or not it is proved to be so in reality, why should not all the mud-banks in the Thames be dredged away, by the combined action of the Metropolitan Board and the Conservators? In such a case, what would be the cost? If this be the *reductio ad absurdum*, should not the Conservators be required to prove a little more than they undertake in the present instance, so as to show the imperative necessity of that which they demand? The point is one which the Board of Trade will doubtless weigh, before issuing any orders on the basis of the report which will ultimately be laid before them.

THE CONTAMINATION OF DRINKING WATER.

One of the characteristics of the present age, of which sanitation, in all its branches, constitutes such a prominent feature, is the attention given to the chemical examination of water for drinking purposes, and the degree of importance attached to the results. The chemical examination of the so-called potable waters constitutes at the present time a branch of chemical analysis to which a large share of time and skill is directed, and which, in its accuracy of manipulation and attention to detail, offers a striking contrast to the older and cruder methods. At the same time, it must be admitted that the whole subject is far from being in a satisfactory condition. Chemists of the highest skill and reputation differ, not only in their views of what constitutes, on the one hand, a harmless water, and on the other a water injurious to health, but also in their opinions as to what particular method of examination should be adopted in order to reveal the true character of a sample of water. In the present article it is proposed to discuss the grounds taken by chemists in either passing a sample of water as harmless to health, or in condemning it as injurious.

Perfectly pure water, the *chemically* pure substance, may be eminently wholesome, but it is a vapid and disagreeable beverage which would require a most peculiar taste to appreciate; yet some leading chemists, chief among whom may be mentioned Dr. Frankland, maintain this as an ideal standard of purity, and the few grains of solid matter per gallon which occur in a reasonably pure, natural drinking water, are characterized as "total solid impurities." Such a cognomen applied to such harmless substances as carbonate and sulphate of lime, with a little magnesia and common salt, is objectionable, on the ground of giving a false impression to the outside public, by which they are led to suppose that *all* solid matter in water is to be regarded as "impurity," and therefore possibly objectionable to health. The majority of chemists, on the other hand, do not regard a moderate amount of mineral constituents in a drinking water as objectionable from a sanitary point of view, and simply record the amount of such constituents as "total solid matter," a perfectly legitimate phrase, which is in no sense misleading.

In natural waters, the dissolved constituents may be divided into three classes—viz., gaseous, mineral solids, and organic solids. Of these, the gaseous constituents—more especially the carbonic acid—give to water its sparkling character and brisk taste, and are, as a rule, entirely unobjectionable; the mineral solids; when in moderate quantity, may also be considered unobjectionable; while the organic solids are considered more or less hurtful, and it is of these last constituents that we wish chiefly to speak.

A somewhat general impression exists that all organic impurities are injurious to health. Such a belief, however, is quite erroneous, for there is no proof whatever that the ordinary class of organic substances found in natural waters are in any way prejudicial to health. Let us examine the sources of the organic impurities in drinking water, and the statement made will be obvious. All natural waters are derived in the first instance from rain, which falls on to the surface of the earth, and eventually makes its appearance as springs and rivers, or is obtained by sinking wells. In passing over the surface of the ground and through the soil, the rain water takes up some of the materials with which it comes in contact, and thus is eventually found to contain constituents derived from the soil. In ordinary cases these constituents consist simply of earthy salts, with occasionally some of the products of the decomposition of vegetable matter; sometimes a manured field or farm will import a greater amount of organic constituents to the water; while sometimes a neighbouring cesspool or leaky sewer will contribute its quota of organic matter. Organic matter derived from all these sources, is, under ordinary conditions, harmless to health—at least, on sufficient proof has at any time been adduced to the contrary. How is it, then, it may very naturally be asked, that water containing even a trifling quantity of organic matter is condemned by an analytical chemist? The only description of organic matter, present in drinking waters, which could possibly prove injurious to health, is that derived from contamination by sewage, and in ninety-nine cases out of a hundred it would be difficult to say that even this description of organic matter could effect any injurious action to health. The exceptional instances, in which waters contaminated by sewage are injurious to health, are those in which the sewage contains excreta from typhoid or cholera patients. In these cases there is a possibility of a spread of disease through the agency of the contaminated water, although we are absolutely ignorant of the nature of the organic substances through which infection is spread, as well as of

the length of time that such substances will preserve their specific disease-producing capacity. This much is, however, tolerably well established—viz., that a contaminated water known to contain the specific organic matter capable of producing disease, does not injuriously affect all those partaking of it, the probability being that those of enervated constitution and little physical stamina may succumb to the disease, in the same way that they would be similarly affected by any communicable disease, while those in robust health and of great physical energy may escape unscathed.

With regard to the specific poisons of various communicable diseases, all attempts at identification have up to the present time failed. Neither the microscope nor chemical analysis has been able to fix upon any particular characteristics in disease-carrying organic matter. To the chemist, such descriptions of organic matter are not recognized as possessing any special features by which they can be distinguished from ordinary nitrogenous organic substances; in fact, a water containing a minute quantity of such a substance as gelatine would be placed in the same category as a water containing the most dangerous form of sewage contamination.

Again, it is the custom with chemists to have particular standards of purity with regard to water for drinking purposes, and, although the more liberal-minded of the chemical profession do not draw an absolutely hard-and-fast line in the matter of purity and impurity, each leading chemist has a particular ideal of purity, and a water which one would pass as harmless, another might condemn. Nothing is perhaps more difficult than to know where to draw the line between a wholesome water and one which, if not absolutely condemned, is at least open to suspicion. We are totally ignorant of the amount of disease-carrying organic matter which must be taken into the human system in order to induce a special form of disease, but the probability is that the necessary quantity is exceedingly minute. If this is the case, a water showing on analysis only a small quantity of organic matter may be dangerous in its character, although the degree of contamination indicated by the analysis is so small that it raises no suspicion in the mind of the analyst. Organic matter in drinking water is either dangerous or harmless in its character; and, if dangerous, it probably preserves such character even in the most minute proportions. A system of classification, therefore, which is founded on the *quantity* of organic matter simply, is empirical, if not absolutely erroneous. A certain margin of organic matter is allowed in natural waters, on the ground that slight contamination from the air, the soil, and the general surroundings, almost invariably occurs without the existence of any dangerous source of impurity. This is perfectly true, but no one can say from analysis whether even a small amount of contamination is not of a dangerous character.

The above remarks are not intended as any slight to the members of the chemical profession, who are, as a rule, gentlemen who bring to bear on their work an amount of skill and scientific training which is perhaps greater than that found in any other profession. What has been said has rather been with the object of showing the existing grounds upon which opinions are founded in pronouncing on the character of drinking water. In the minds of the general public a most erroneous impression exists on the subject of organic matter in water. "Organic nitrogen" and "albumenoid ammonia," although, in this age of scientific education, "familiar in our mouths as household words," are nevertheless terms of dread meaning, the mention of which is enough to make the otherwise healthful visage of the master of the house overspread with a deadly pallor. To tell him that the water supplied to his house contains "albumenoid ammonia" or "organic nitrogen," and to throw out at the same time dark hints of that scarecrow, "previous sewage contamination," is an announcement of as direful import as if arsenic or strychnine had been discovered in the water. His case is an exemplification of the truth of the adage that "a little learning is a dangerous thing," for he is ignorant of the fact that even if his drinking water is not so pure as it might be, the chances are perhaps a thousand to one that the contamination is of a dangerous character.

With regard to the scientific examination of drinking waters, although the present grounds on which opinions are formed are anything but satisfactory, it is difficult, if not impossible, in the present state of knowledge, to suggest any remedy. If it be admitted as a fact that organic contamination in a drinking water *may* be dangerous in its character, and also that no specific tests are known by which to distinguish organic matter which is harmless from that which is hurtful, the wisest course is to condemn all waters about which the least suspicion exists, although such wholesale condemnation unfortunately includes nine hundred and ninety-nine perfectly harmless waters for one absolutely hurtful. Perhaps the strongest argument in favour of condemning all waters in which contamination by sewage is indicated is this—that such contamination proves the existence of a channel of communication between the sewage and the water supply, and that although no specific danger can be said to exist as long as the sewage is *healthy* in its character, in the event of an outbreak of cholera or typhoid fever—in which case the sewage may be spoken of as *diseased*—a means would exist for the spread of the disease through the agency of the drinking water. At the same time, it must be considered greatly desirable that the present exaggerated ideas which prevail with the public, as to the contamination of drinking water, should be dispelled, and the subject regarded in its true light. If this were the case, there would be less opportunity for the alarmist school of water agitators to set the public mind in a periodical ferment about our present supply of water for drinking purposes, which we firmly believe is sufficiently good to be satisfied with, and of sufficient purity to render a supplementary supply from a special source quite superfluous.

Communicated Articles.

SULPHUR IN COAL GAS.

By "DELTA."

(*Continued from p.* 703.)

As far as practical knowledge extends, no method is known by which sulphur in coal gas can be kept down to 20 grains in 100 feet, except by the employment of foul lime (calcium sulphide) to absorb the carbon bisulphide. I am aware that the phrase "practical knowledge" may be objected to in some quarters, and that I should be guilty of a fallacy were I to argue that a process might be theoretically good, and yet fail in practice. There are methods known by which a certain bulk of coal gas can be freed from carbon bisulphide—methods which, as far as experiments have gone, have proved to be practicable *on the scale of the experiment*, but which have not therefore been proved to be possible on the large scale necessitated by coal gas purification. A process is theoretically good when it succeeds under *all* the conditions to which it will be subjected in practical working; then we are assured that, under like conditions, the same effects will be produced by the same causes. A process that is said to be "all very well in theory, but no good in practice," may be really "all very well" in *a* theory, but that theory is not the true one. Theory, if it be the true theory, always agrees with practice.

It cannot therefore be urged that the means of effectually purifying London coal gas from carbon bisulphide without the use of foul lime are known, although there may be the strongest possible reasons for believing that those processes which have been successful on a small scale would be equally successful for purifying the enormous make of the London Gas Companies. Take, for instance, the method originally devised by Mr. Bowditch, and again brought forward in a modified form by Mr. Vernon Harcourt, for converting the carbon bisulphide into hydrogen sulphide, by passing the gas, already purified from hydrogen sulphide, over heated surfaces. As a laboratory experiment, this process is perfectly successful; tried on a large scale at gas-works, it failed, not owing to any fault in the chemical reaction, but on account of an engineering difficulty. The gas chamber, made of iron plates, cracked with the heat, and by the combustion of the escaping gas became too strongly heated. Mr. Harcourt has shown that the reaction takes place at a much lower temperature when the coal gas is passed over finely divided metallic platinum. Pumice is steeped in a solution of platinum perchloride, which, on heating, is decomposed, leaving the metal in a very fine state of division, spread over and through the porous pumice. It is reasonable to suppose that a cubic yard of such platinized pumice would produce the same effect on coal gas as a cubic inch does on a corresponding volume at a particular temperature, but until the experiment is actually made it cannot be said to be a practical method of gas purification.

Should such an experiment be made on the manufacturing scale? This is a difficult question to answer. Directors of Companies, in the interest of shareholders, naturally shrink from expending a large sum on a trial experiment which may possibly only show the untrustworthiness of the method. Few private individuals have the capital or facilities for making the experiment. It is contended by those who are in favour of keeping the sulphur down to a minimum by the use of foul lime, that the pressure applied to the Companies acts as an inducement to them to carry out such experiments, and that were the pressure relaxed, they would make no effort to improve the manufacture — competition being removed by the division of London into districts, and by the late amalgamations which have almost brought London north and south of the Thames under two great Gas Companies. But although competition between rival Companies is no longer an incentive to better the modes of gas purification, another form of competition has arisen—that between gas and petroleum. Since the introduction of the "duplex" and the Silber lamps, burning petroleum oils of high boiling point, the public are no longer dependent on gas companies for a brilliant illumination. No sulphur is contained in the oil, and consequently no sulphurous acid is given off by the flame of the lamp. The Companies do not despise their new rival, but they are endeavouring to defeat it, not by diminishing the sulphur in their gas, but by striving to keep down the price. To compete with petroleum, gas must be cheap. By a return to the oxide of iron purification the gas could be reduced in price 2d. per 1000 feet. The extra quantity of sulphur in gas so purified does not injure the consumer; by both systems of purification sulphur is retained in the gas, and sulphurous acid produced on combustion; but in the one case the consumer pays more, and gets rather less sulphurous acid than he does in the other case where he pays less. As far as general consumers are concerned, the Companies would be willing to meet their wishes as to purity and price. They believe the consumer would rather have the cheaper gas, and were they allowed to sell the impurer gas at the cheaper rate, their conviction is that, in spite of "sulphur," coal gas would find its way into dwellings of the poorest class, and replace tallow candles and crude petroleum. The Companies admit that the presence of a large quantity of sulphur in gas is unpleasant, if not injurious to the consumer; but they contend that it is both to the interest of the consumer and the general public that gas should be cheaper, and that the nuisance caused by foul lime purification should be abolished, the advantages of the oxide process more than counterbalancing the disadvantages, if there be any, of the increased quantity of sulphur.

It is a question for the Companies and their customers; the Companies will be sure to accommodate the supply to the demand, and will endeavour, since they have no monopoly in lighting, to secure

the greatest amount of custom by meeting the wishes of the public. The removal of the sulphur restriction, so as to allow a return to the oxide method of purification, is opposed by the Metropolitan Board of Works and by the City Corporation, on the ground that the consumers do not desire a diminution in the price of gas at the cost of increased sulphur impurity, which acts injuriously on the furniture, pictures, and books contained in rooms where impure coal gas is burnt. The Metropolitan Board further contend that the foul lime process can be carried out with proper precautions, so as to create no nuisance to the neighbourhood.

On these two issues the sulphur question was fought before a Parliamentary Committee two years ago. The Crystal Palace District Gas Company promoted a Bill to repeal the section in their Act of 1873, which requires the gas to contain not more than 20 grains of sulphur in 100 feet. The Gaslight and Coke Company promoted a Bill that sought to repeal the section in their Act of 1876, which provides that the Gas Referees shall prescribe the maximum impurity with which the gas supplied by the Company shall be allowed to be charged. The highest scientific evidence was produced on both sides as to the injury alleged to be done to health and property by sulphurous acid produced in the combustion of coal gas. The medical evidence was conclusive that no injury resulted to health from the sulphur in coal gas. Dr. Meymott Tidy stated, in his examination before the Committee, that the *employés* of the Metropolitan Railway were remarkably healthy, in spite of the very large amount of sulphurous acid in the atmosphere they had to breathe, and that the men had applied to have their subscriptions to their "insurance club" reduced, on account of the very few cases of illness that occurred amongst them. The "stuffiness" in gas-lighted rooms insufficiently ventilated, appeared, from the evidence of Dr. Odling, to be probably due, not to sulphurous acid, but to imperfectly-burnt hydrocarbons escaping into the atmosphere. By drawing the air of a room in which coal gas had been burning for some hours, over heated copper oxide, Dr. Odling determined the amount of gaseous hydrocarbons present in the room. The air being freed from carbonic acid before passing over the heated copper oxide, the amount of carbonic acid produced in the process gave the amount of carbon existing as gaseous hydrocarbons in a given volume of air. In this way it appeared that when in a room lighted by ordinary gas-jets, the amount of carbonic acid in one cubic foot of air reached 3 grains, the amount of imperfectly-burnt hydrocarbons reached 1 grain.

The question of injury to property must next be considered, and, lastly, the possibility of carrying on the foul lime process without creating a nuisance.

(To be continued.)

THE MODERN PHASE OF PHYSICAL SCIENCE.

By "Isca."

There is no more interesting or important branch of Physical Science than that which is known as Heat, by which rather lame title we endeavour to express our theories and experience of one of the most subtle attributes of matter—a property which is, perhaps, the proximate cause of the existence of matter itself, as we know it. Yet in the present day it can hardly be said that our knowledge of any branch of the "undulatory forces" of Light, Heat, and Electricity, or of them all in their grand unity, is anything more than elementary. The doctrine is of very recent date, which teaches that those manifestations of the existence of matter which are capable of acting *outside* the matter itself—such as the light by which we see it, the difference between its temperature and that of our bodies, the electrical or magnetic phenomena which it presents to our notice, and even its palpable feel—are all modifications of the one principle by virtue of which it exists in a concrete form. Human intelligence cannot embrace the idea of a fundamental principle in its essence, even when the existence of such a thing is indicated by a host of concurrent witnesses, without considerable effort, based on the patient assimilation of many disconnected facts, the very retention of which, necessary as it is for the eventual detection of their single identical underlying principle, is almost impossible until the principle itself is firmly grasped; and by the very act of its discovery the hitherto disjointed observations are made plain, as a powerful and connected chain, any few missing links of which can be subsequently supplied.

No one can have a just appreciation of the physical properties of the visible universe until he has acquired a true appreciation of the basis upon which the undulatory theory depends. This is not difficult when one great obstacle is fairly surmounted—viz., the difficulty which arises from the slavery of the human mind to its tributary senses. We have to take our knowledge of the physical world at first from the testimony of our senses, and, to a certain extent, the mind must be taught by their assistance; but there is a point at which the powers of reason transcend the powers of sense, and when that boundary is passed the senses must become the pupils of the mind instead of its tutors, and investigation proceed on the line laid down by the aphorism, "Things are not as they seem."

The first thing that a novice in the arcana of physics has to learn is that matter of any kind, known to him by any name, must be considered as having an entity entirely irrespective and independent of his sensual knowledge of it. The tangible or visible embodiment of it with which he has long been familiar, is apt to be regarded by him as the very thing itself, instead of an accidental property thereof. (I use the word "accidental" here in its logical meaning, and not as an effect of chance.) The substance known to us as water is a fair example of this. When its common name is thus mentioned, the vision of a colourless liquid is instantly conjured up in the mind, and it is not without an effort that solid ice and invisible aqueous vapour are conceded to be one and the same thing with it. The result would be the same if we were chiefly conversant with it in the form of a solid or a gas; its ordinary presentment would still be suggested to us by its name, instead of its properties, which are far more important. It is so with other substances. We invariably think of iron as a dense metallic solid instead of as a liquid or a vapour, in either of which forms it is none the less iron, and we remember carbonic acid as only a gas. Our senses master us unconsciously, and we still confound the substance with its accidents, and *vice versâ*. This failing in the direct and immediate application of reason to the appreciation of matter is aggravated by the occurrence in ordinary language of different words for the same matter in different forms, such as ice, water, steam, vapour, snow, &c., for the entity H_2O.

Its practical disadvantage is evident in commencing the study of chemistry. Take, for instance, the union of iron and sulphur, or iron and oxygen. How much easier it would be to understand the operation of chemical affinity in the formation of a compound of two or more elements, each probably commonly known to us in an apparently solid form, if we could instantly appreciate the existence of each element in a more plastic form. We can readily understand the mixture of two similar liquids or gases, but how are we to comprehend the union of solids, until our reason shall have triumphed over our senses, and conveyed to us the knowledge which our unaided senses alone would never have suggested—that the difference between gases, liquids, and solids is only one of degree? The use of chemical symbols is of value in this respect, no less than for their brevity and power of expression. In their constant application it is possible, as it is essential to the attainment of scientific accuracy, to ignore the transitory form of any substance, and to keep before our minds only its vital characteristics. In order to arrive at a true knowledge of any substance, the whole of its protean changes and embodiments must be capable of review at any moment when the mind is directed to it; and this can only be done when its common form can be clearly seen to be only a form, and not the thing itself.

Such considerations as these lead at once to reflection on the property which is the cause of the various conditions of matter, so that at one time a substance shall be opaque, hard, and solid, at another a translucent, limpid liquid, and again a diffusive, transparent, and intangible gas, and yet possess the same relationship to other substances, and, except as regards its presentment to our senses, remain precisely the same thing in every guise. Formerly this phenomenon was dismissed by referring the concrete state of matter to the existence of two forces acting simultaneously, but in opposite directions, the force of cohesion tending to draw the atoms of the substance closer together, and that of repulsion operating to separate them, the general state of any substance, whether solid, liquid, or gaseous, depending upon the predominance of one or the other. But names are not things, and after having named these forces, their nature and origin remained as obscure as ever, although the acceptance of such a theory was so far a gain inasmuch as it disposed of the idea of a perfectly solid homogeneous body. The existence of any such we now know to be impossible. We thus get to the idea of a solid body as something so belied by its name that its component particles do not touch each other at all; that is to say, that it is not different even in form from its own vapour, but only in the distance between the same atoms under distinct conditions. Then it was suggested that these forces, or rather their effects, were connected with heat in some way. Heat, it was known, changed the condition of some substances, and transformed others, and as this could only be done by causing a motion of their atoms, heat became recognized as motion, and the cause of motion; for the power which can move an atom can, of course, move any number of atoms, if its relative value be preserved. Pendent to this discovery comes its converse—that motion is reconvertible into heat. Light, then, takes its place as another phase of the same principle, and electricity and magnetism claim common ancestry therewith. And the great organic mysteries of life and volition—who shall say how similar to, or distinct these may be from the principle that stirs in the atoms of the pebble which we displace with our foot? What is this principle, if there be but one, which gives life, light, heat, and power to everything which this world contains? We know no more than we do of what all matter consists.

The tendency of discovery is to simplify. The earliest machinery worthy the name is always more complicated than is necessary to effect the desired purpose. Eventually the superfluous parts are omitted, and the object is gained in the directest way possible, till the most improved engine appears infinitely easier to invent and make than the involved arrangement of cranks and levers which it supersedes. So it is with the fabrics of the mind. A stupendous array of rules and formulæ is gradually cleared away, as knowledge increases of the simple laws around which they have grown, and the finally ascertained principle may lie in a nutshell. Will it be proved that there is but one principle of energy and one kind of matter in the universe? The balance of evidence is inclining to the realization of the former idea, and one by one substances, erstwhile reckoned as elements, are broken up, and we hear the assertion made that of the whole number hydrogen only will remain, sole and indivisible, the prime substance of which all things are made.

It may be thought that such considerations as the foregoing can be of little practical value; but he would be extremely bold who would condemn the researches of Professor Crookes or Mr. Norman Lockyer on such grounds. It was reserved for the doctrine of the Conservation of Energy—apparently as abstruse a subject as could well be imagined—to put an extinguisher on the *ignis fatuus* of Perpetual Motion, which has proved a sore curse to so many; and by

taking due interest in the labours of all seekers after truth, even when they may seem to be getting rather out of their depth, we may perchance find something of value that they may have passed over or thrown aside. Professor Crookes's researches into the properties of radiant matter as bearing on the action of light, to which he has been devoting himself since his discovery of the so-called radiometer, will doubtless bear rich fruit sooner or later, for himself and for the world. Others are treading in the path he has marked out, and there is room for all who will emulate his labours in the field which lies before him. Never has there been so much restless effort in this direction as there is at the present day, and whatever may be the amount of it which appears to yield barren results, these still form a very firm foundation for greater discoveries in the future. Mechanical science attracts but little attention in comparison with the fascination exercised by the more recondite subjects which have been briefly mentioned here. The world has greatly changed of late in the quality of men whom it delights to honour, and calls learned and wise. No man is learned or celebrated now for his powers of Latin or Greek versification. That old-world standard of culture is rapidly declining, and Physical Science is in the ascendant. This is the spirit of the age. No one is content to study the record of the knowledge of another, except as a guide to something beyond. We cannot tell to what extent research can penetrate, but we do know sufficient to make us eager for more. We cannot stand still. Onward we must go, whether we will or not, and the only safe course is to join in the race, and work for ourselves at the same time.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

MR. PATTERSON ON THE CONTACT OF TAR WITH GAS.

SIR,—In the interesting article, on the contact of tar with gas, in the JOURNAL of the 4th inst., my friend Mr. Patterson has in one particular made a slight mistake, by "putting the cart before the horse."

He says, in reference to the tars that are mechanically suspended in the gas after proper condensation, that, in 1871, he "suggested the employment of a large chamber," wherein, the velocity of the gas stream being greatly diminished, "the tar may settle down." He then states that "such chambers have since then been adopted at the South Metropolitan Gas-Works." Now, these chambers were in use here some years before the first Referees were appointed, and I think it most likely that Mr. Patterson's first idea on this point was derived from his inspection of these works as Referee, when I explained, among many other things, the reason of the erection of these chambers, and the good effect they produced.

Considerable inconvenience had been caused by the gas, although properly cooled, carrying forward a certain portion of rather heavy tar to the exhausters—due, as I thought, to the velocity at which the gas travelled. To remedy this, the first idea was to place a small balanced gasholder between the condenser and the exhausters; but at the time this could not well be done, and some wrought-iron tubes, 20 feet long and 4 feet diameter, lying out of use on the premises, were so arranged that the gas was passed simultaneously through five of them. This put an end at once to all trouble with tar in the mains or exhausters, and checked to a great extent the oscillation in the hydraulic main caused by the exhauster. After these chambers were erected, a notable improvement took place in the working of the exhausters, owing to the abstraction of the heavier tars, and leaving behind only the lighter ones, which act as a necessary and excellent lubricant.

In the new portion of the works, we have just completed a balanced gasholder 30 feet in diameter, with an annular tank 15 feet deep, thus providing a settling chamber about 30 feet deep and 30 feet diameter, which, it is hoped, will both remove the tar and prevent all oscillation from reaching the hydraulic main.

GEORGE LIVESEY.

South Metropolitan Gaslight and Coke Company,
589, Old Kent Road, S.E., Nov. 6, 1879.

SIR,—Having read the articles on the above-mentioned subject, written by Mr. Patterson, late Metropolitan Gas Referee, and granting that gas managers do admit that coal gas *washed* through coal tar at low temperatures seriously diminishes the illuminating power of the gas so washed, we must also admit that, in the process of gas manufacture, the very first wash that the gas gets is in the hydraulic main. To quote from your JOURNAL of the 14th ult., p. 582, Mr. Patterson says:

"The hydraulic main, as ordinarily used, is really a tar bath, in which the gas at its outset is thoroughly washed with the tar. The hydraulic main, or water-trough, has long been employed as the most convenient means of sealing the outlets of the retorts, so as to prevent any back-flow of the gas into the retorts during the drawing and charging. But the water with which the hydraulic main is originally filled is quickly converted into, or, rather, is replaced by liquid tar; and the gas is thoroughly washed by this tarry liquor as it bubbles up through it from the mouth of the dip-pipes."

I consider that Mr. Patterson's condemnation of the practice of permitting the hydraulic main to be in reality nothing short of a "tar bath" for the gas, is the most valuable and chief point of interest to gas managers in the articles referred to.

It is now nine years since I designed a very simple and inexpensive little apparatus, to be fitted into, or, if desired, on the end of each hydraulic main, for the purpose of emptying all tar out of the hydraulic main, and leaving only the natural ammoniacal water to seal the dip-pipe; as also to regulate the amount of seal on the dip-pipes at any time the manager might wish to do so, whether the retorts were in active operation or not, and while regulating the seal the operator could read off at a glance the actual dip on the dip-pipes, without reference to any other gauge.

There is no reason why our hydraulic mains should be stigmatized as being "tar baths," nor in reality be anything else than simply hydraulic mains.

The hydraulic main overflow and regulator I refer to has been in use at the Dumbarton Gas-Works for eight years, both with and without an exhauster, and I will refer to the opinion of the present Manager as to its working; it was adopted at several gas-works shortly afterwards, and has been reported on favourably at all of them.

It is well to begin at the foundation to repair any error admitted to exist at the very base of our operations, so as to allow of there being a solid foundation for further improvements, and I attach so much importance to the employing of the hydraulic main for its proper uses, that I have taken the liberty of drawing the attention of gas managers to the design I refer to. I read a paper on the subject at the meeting of the West of Scotland Association of Gas Managers in 1873, a report of which will be found in the JOURNAL, Vol. XXII., p. 325, along with a drawing. A paper on the subject was also read at the meeting of the North British Association of Gas Managers in 1876, and the design was again shown in the JOURNAL, Vol. XXVIII., p. 242; and, notwithstanding the adverse criticism the arrangement then received, it is the most simple instrument that could be thought of. I am well aware of how largely it has been imitated and adopted, and not the least of its recommendations is that its adoption is not hampered by any patent rights.

My attention was drawn last week to statements made at the recent meeting of the West of Scotland Association of Gas Managers, where Mr. M'Gilchrist, Manager of the Dumbarton Gas-Works, speaking of my arrangement, said: "At Dumbarton, I may state, Mr. Key fitted up an overflow for the hydraulic main, which, I think, is second to none that I am acquainted with;" while Mr. Brodie, of Paisley, added, "Mr. Key's apparatus is excellent."

I excuse myself for bringing this matter forward at the present time, solely on account of the hydraulic main, as a "tar bath," being the real subject of interest in Mr. Patterson's papers, published in recent numbers of your JOURNAL; the other remarks, as to removing hydrocarbons from coal tar, being only interesting or applicable to manufacturers of coal tar, and not of so much importance to manufacturers of coal gas. I also agree with Mr. M'Gilchrist that I have not seen any design better fitted to put the hydraulic main to its proper uses, combined with smallness of cost and simplicity of construction.

I may add that I have not noticed any depreciation of the quality of gas, which is simply *passed over* tars, or over the oil usually floating on the surface of gasholder-tanks, but consider a thin coating of oil on the water in the tanks an improvement, by preventing dry gas from absorbing vapour which might otherwise rise from the water.

Gas-Works, Tradeston, Glasgow, Nov. 5, 1879. WILLIAM KEY.

STREET LIGHTING CONTRACTS.

SIR,—The Clerk of the Local Board whose district my Company lights, requires (for the first time) a penalty clause to be inserted in the contract for lighting public street-lamps. Can you or any of your readers inform me if it is usual and necessary for Gas Companies to accept penalty clauses in their contracts with Local Authorities?

A COUNTRY SECRETARY.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, Nov. 7.

(*Before the* MASTER OF THE ROLLS.)

DAVIS *v.* THE ISLE OF THANET GAS COMPANY.

This case, which came twice before the Vacation Judges, as previously reported, involved an important question as to the powers of the defendant Company under their Act of Parliament. Mr. Davis, the plaintiff, who is owner of considerable property at Westgate-on-Sea, sought to restrain the defendants from laying their gas-mains through his land without his consent. It was stated to Justice Stephen, one of the Vacation Judges, in September last, that the pipes having been laid by the Company in defiance of the plaintiff, and relying on the powers given them by their Act, Mr. Davis had taken the law into his own hands and cut the pipes, he alleging that his property was not within the limits of the Company's Act. Where the plaintiff had cut the gas-pipes on the highway, at the boundary of his estate, an extensive escape of gas had, it was stated, occurred, entailing serious loss on the Company; but the mischief had been stopped by the order of the Vacation Judge directing that the pipe should be repaired, and the question of damage then stood over to the hearing, the question between the parties being whether the Company had a right to lay their pipes through a private estate, the Company contending that their Act gave them power to lay mains along any highway, and that the roads on the plaintiff's estate were, in fact, public thoroughfares.

Mr. BAGSHAWE, Q.C. (with whom was Mr. CUTLER), on behalf of the plaintiff, asked that the injunction should now be continued (having only been granted to this date) restraining the defendants from laying down additional gas-pipes through the plaintiff's land until the legal issues could be decided by the Court on the trial of the action, the question being really not one of facts, but of law.

Mr. CHITTY, Q.C. (with whom was Mr. CHAPMAN BARBER), for the defendants, dissented from the latter statement, and said the facts were disputed, especially with reference to the cutting of the gas-pipes, and the serious loss the Company had sustained in consequence. It would be clearly proved to the Court that the defendants had acted entirely within their rights under their Act, the question whether they had not exceeded their powers being really the point the Court would be asked to decide.

His LORDSHIP declined to hear the arguments on a point of law upon a "motion day" reserved for passing interlocutory business, and ordered the case to stand over until the hearing of the action, the defendants giving an undertaking not in the interval to lay any more pipes through the plaintiff's property.

RETFORD WATER SUPPLY.—The Retford Town Council are about to carry out a scheme for the supply of water to the town. Boring operations have for some time past been carried on at the west end of the town, and water has been found of good quality and in abundance. The water is to be pumped up to a tank placed on the top of a tower 60 feet high, and from thence distributed to consumers. The cost of completing the work will be nearly £11,000.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in October:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen. — As Nitrates, &c.	Ammonia. Saline.	Ammonia. Organic.	Hardness (Clark's Scale). Before Boiling.	Hardness (Clark's Scale). After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	21·40	0·103	0·135	0·000	0·008	13·7	4·6
West Middlesex	21·40	0·111	0·129	0·000	0·010	13·7	4·2
Southwark and Vauxhall	21·60	0·088	0·117	0·000	0·008	13·2	4·2
Chelsea	21·00	0·085	0·138	0·000	0·008	13·7	4·6
Lambeth	21·10	0·092	0·148	0·000	0·009	14·8	4·3
Other Companies.							
Kent	29·46	0·022	0·480	0·000	0·005	19·4	6·5
New River	21·00	0·052	0·126	0·000	0·006	13·7	4·3
East London	20·00	0·086	0·144	0·000	0·008	14·3	4·2

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c. is determined by a standard solution of permanganate of potash acting for three hours

The water was found to be clear and nearly colourless in all cases.

C. Meymott Tidy, M.B.

INSTITUTION OF CIVIL ENGINEERS.

The Council of this Institution have just issued a list of the subjects upon which, as well as upon other analogous questions, they invite original communications, either for reading and discussion at the weekly meetings, or for printing in the "Minutes of Proceedings" without being publicly read and discussed. For approved original communications the Council will be prepared to award premiums, arising out of special funds bequeathed for the purpose.

Among other subjects for papers there are—

The Principles underlying the Progress of Economy in Gas Production and Distribution, with recent Methods of Purification.

On Proportioning Mains for the Distribution of Water and Gas.

The Relative Advantages of Steam, Heated Air, Gas, Water, and Electricity as the Motive Power in small Engines.

The Various Chemical and Protective Solutions or Coatings for the Surfaces of Metal Work exposed to Corrosion, with Instances of their Use and Durability.

The Causes of Slips in Rocks and in different Earths, and the Conditions that induce Treacherous Ground in Railway Cuttings, Tunnels, and the Sides of Valleys near Reservoir Banks.

The Various Descriptions of Pumps employed for Raising Water or Sewage, and their relative Efficiency.

BRISTOL UNITED GASLIGHT COMPANY.

An Extraordinary Meeting of this Company was held last Wednesday—Mr. F. Terrell in the chair—"for the purpose of authorizing the Directors of the Company to issue from time to time new shares or stock of a nominal value not exceeding the sum of £100,000, and to exercise the borrowing powers of the Company in respect of the said sum of £100,000, either by the issue of debenture stock or on mortgage, at their discretion."

The Secretary (Mr. H. H. Townsend) having read the notice convening the meeting,

The Chairman said the sum named appeared rather formidable, but it must be understood that they would not need it all at once; in fact, they would only require a very small amount of it at the present time, and would call up the rest of it at such times, and in such sums, as became necessary for the purpose of new or extended works. Taking powers to raise £100,000 would do away with the necessity of the Directors calling the Shareholders together half-a-dozen times, and they would have power to raise one-fourth of the capital in debentures. A large amount of money had been spent on the Company's new works, the first portion of which had been finished, and the cost had been paid, with the exception of a very small amount, so that they were not likely to require the new capital immediately. He moved the adoption of the report of the Directors recommending the proposed issue.

Mr. W. Spark seconded the motion.

The Rev. P. Sleeman thought that, instead of issuing 4 per cent. debentures to the public, they might issue debentures bearing 6 or 7 per cent. interest to the Shareholders, which would give them a bonus on their shares. He thought the Company might issue them to bear any interest they chose. He asked whether this matter had been taken into the consideration of the Board.

The Chairman said he did not think that would be within the powers of the Act of Parliament.

The Rev. Mr. Sleeman said it was not unusual in other companies.

The Solicitor (Mr. A. Brittan) said up to a very recent date they were restricted from issuing more than 4 per cent. debentures but he was inclined to think that there was a new Act of Parliament which gave them increased power. The Company had, however, always followed one precedent, and issued the debentures to the public. There might be some objection if they placed them simply amongst their own proprietors. He thought it was a matter to be left to the Directors for consideration.

Mr. J. D. Weston said it would be a question not only of their legal power, but as to the policy they should pursue. If they issued 6 per cent. debentures in the manner indicated, they might be prejudicing the undertaking. Hitherto they had acted on the broad principles of their Act of Parliament. He did not think the Directors would feel that they would be promoting the interests of the undertaking by issuing 5, 6, or 7 per cent. debentures. At the same time, no doubt the Directors would take the suggestion into consideration.

Mr. W. Spark said he believed the debentures must be offered to the general public, and he thought the Company should obtain the money as cheaply as possible.

The Rev. Mr. Sleeman said he should be pleased to leave the matter in the hands of the Board.

The motion was then put and carried, and

The Chairman moved a resolution empowering the Directors to issue debenture stock in accordance with their Act of Parliament.

Mr. W. Spark seconded this proposal, which was carried.

The meeting then ended.

Sale of Stock in the Preston Gas Company.—On Monday, the 3rd inst., Mr. H. C. Walton sold £100 worth of A stock in the above-named Company for £183, and £72 of B stock for £134.

BAHIA GAS COMPANY, LIMITED.

The Ordinary Half-Yearly General Meeting of this Company was held at the London Offices on Thursday last—Edward Horner, Esq., in the chair.

The Secretary (Mr. A. J. Head) having read the notice convening the meeting, the following report of the Directors was presented:—

The Directors herewith present the statement of accounts for the half year ending June 30, 1879.

The half year's working has resulted in a profit of £4416 12s. 9d. (after payment of extraordinary disbursements and the expenses in respect of the customs duties), which, added to the balance brought forward, makes the sum of £5693 12s. 10d., out of which the Directors recommend the usual dividend on the preference shares, and a dividend at the rate of 4 per cent. per annum on the ordinary shares. This will absorb £4125, leaving £1568 12s. 10d. to carry forward.

The Directors retiring by rotation are Mr. Edward Horner and Mr. Arthur John King, and the Auditor retiring is Mr. Joseph Wright; who, being eligible, offer themselves for re-election.

Balance-Sheet, June 30, 1879.

Dr.		Cr.	
Capital—		Concession	£7,000 0 0
5000 ordinary shares	£100,000 0 0	Investment to Dec. 31, 1878	103,108 11 6
1000 10 per ct. preference shares	20,000 0 0	Additional during half year	1,915 12 7
1500 7½ ditto ditto	30,000 0 0	Freehold land	5,033 12 7
Debentures	2,650 0 0	Meters fixed	2,582 12 6
Creditors—		Office furniture and fixtures	319 16 8
On open accounts	2,075 10 6	Preliminary expenses	16,914 17 3
On acceptances	5,308 17 7	Suspense account—	
Dividends unpaid	123 12 3	Mains renewal	3,476 1 10
Debenture interest	77 16 10	Amount due for gas, fittings, &c.—	
Insurance-fund	47 4 10	Public lighting	1,580 16 11
Reserve-fund	2,500 0 0	Public establishments	3,084 13 0
Profit and loss	5,693 12 10	Private rental, fittings, &c.	7,189 1 2
		Sundry debtors	178 9 8
		Stock—	
		Coals	7,334 3 6
		Turba	281 5 11
		Coke	115 17 6
		Fittings	2,482 9 4
		Sundry other stores	2,214 15 8
		Goods in transit	803 9 6
		Bills receivable	2,000 0 0
		Cash at Bankers—	
		General account	175 5 9
		Dividend account	201 9 1
		London office	10 5 0
		London and Brazilian Bank	404 1 5
		Bahia office	69 5 9
	£168,476 14 10		£168,476 14 10

Revenue Account, for the Half Year ending June 30, 1879.

Coals carbonized	£5,192 2 5	Gas supplied to—	
Purifying materials and wages	196 18 8	Public lamps	£9,729 18 5
Carbonizing wages	1,117 17 1	Less fines	231 1 0
Wages, yardmen, &c.	181 4 0		£9,498 17 5
Repairs, &c., of mains, and services	593 15 6	Private consumers	6,975 6 0
Lighting and repairing public lamps	1,209 15 4	Public establishments	839 1 11
Salaries	1,758 17 5	Meter-rental	556 0 10
Directors fees	400 0 0	Products £2,318 4 11	
Auditors fees	21 0 0	Less labour 98 19 7	2,219 5 4
Rent and taxes	215 14 8	Transfer fees	1 16 0
Interest and discount	105 9 8	Profit on fittings	356 1 4
Stationery	89 8 8	Bad debts recovered	9 11 5
Office expenses	16 12 4		
Trade charges	230 18 1		
Travelling expenses	23 3 5		
Wear and tear	1,146 3 2		
Bad debts and allowances	304 8 7		
Exchange	901 15 2		
Law charges	3 13 0		
Extraordinary disbursements—			
Renewal of plant (last instalment)	265 5 0		
Renewal of mains—			
One-sixth of £585 16s. 5d. (last instalment)	97 12 8		
One-sixth of £3424 19s. 10d. (4th instalment)	570 16 6		
One-sixth of £560 18s. 5d. (3rd instalment)	93 9 9		
One-sixth of £618 10s. 10d. (2nd instalment)	103 1 10		
One-sixth of £1969 18s. 8d. (1st instalment)	328 6 7		
Expenses *re* customs duties	870 0 0		
Balance, being net profit for the half year	4,416 12 9		
	£20,456 2 3		£20,456 2 3

Profit and Loss Account.

Dividends declared May 22, 1879	£4,125 0 0	Balance Jan. 1, 1879	£5,481 10 1
Debenture interest to June 30, 1879	79 10 0	Revenue account, profit for the half year ending June 30, 1879	4,416 12 9
Balance	5,693 12 10		
	£9,898 2 10		£9,898 2 10
		Balance	£5,693 12 10

The Chairman, in moving the adoption of the report, congratulated the Shareholders on the prosperous position of the Company. Referring to the several items in the account, he said there was great encouragement for the future that when the exchange righted itself, as to which he had no doubt, there would be ample funds to pay a rather higher dividend than the Shareholders now received, and leave something over. There was another item—a heavy one—of £870, which had been expended in endeavours to obtain the remission of the duties which had been imposed on them. He was sorry to say that up to the present they had not succeeded in those efforts, but they had lately memorialized the Government on the subject, and they hoped eventually that justice would be done them. He saw no reason why they should be treated differently to the Rio or other Gas Companies, and they hoped to be able to show that they were entitled to all their concession granted to them. Turning to the revenue account, he said that they had received £100 more from the public lights; they had been fined a little more—under £20; they had received £980 more from private consumers, and something less from public establishments. However, on the whole, the receipts were exceedingly satisfactory, and, coupled with a reduction in the general costs of the concern, the profit was £1240 more than it was the corresponding half of last year, which, he thought, as they had lost £900 by exchange, and had had an exceptional expenditure of £870 in trying to get back the duties which had been imposed on them, proved that the account was a very good one. If they had not been put to exceptional expenses, their profit would have been £6400 instead of what it was. The exchange, however, was righting itself to a certain extent, and he hoped that the next time they would not

have this expenditure of £870, and that they would be better in regard to the exchange. The instalments, too, for laying down mains, pipes, &c., were working off, and there would be less to deduct for those items now. They had not been expending so much lately, owing to the duties imposed upon them, but they would like to do more than they had been doing. He thought they had shown that the money they had invested in these pipes had benefited the position of the Company, as the leakage was over 30 per cent. when they were laid down, and this had now been brought down to something under 12 per cent.; and if they could only get the mains perfect over the whole system, they might look for a further reduction of 2 or 3 per cent. He then moved the payment of the full dividends on the 10 and 7½ per cent. preference shares, and of a dividend at the rate of 4 per cent. on the ordinary shares.

The DEPUTY-CHAIRMAN (Mr. H. Brothers) seconded the motion.

Mr. H. H. MAUDE asked what was the amount in question which they had been endeavouring to recover.

The CHAIRMAN: Between £8000 and £9000.

Mr. MAUDE presumed that the expenditure included in the £870 was not continuous—that this was the whole expenditure.

The CHAIRMAN replied in the affirmative, and added that there was not one farthing more to pay. It was really worth risking something to get back such a large sum, and also with regard to the future. Let them imagine the position of the Company if they could recover this money—what a flourishing position they would be in—it would, in fact, make all the difference to them.

Mr. MAUDE asked if some of this expenditure of £870 was not in law expenses.

The CHAIRMAN said it was part in law expenses and in sending a person out to arrange the matter for them.

Mr. ALFRED PENNY remarked that the question of the Brazilian Government violating the terms of the concession to the Company had been discussed very fully at the last two meetings. He was a Shareholder in another Company, and had made himself acquainted with the conditions of that Company, and he found that they were paying no *expediente* on what they imported, and were paying no duties. He would like to ask whether the gentleman whom the Board sent out to Rio was perfectly aware of the conditions that the Brazilian Government exacted in connection with these matters. They received no representation except through the President of the district. His going there without being armed with that representation was simply idle. The Chairman had told them that there was no result from the efforts which had been made, and he was not surprised to hear it. The method by which the Pará Gas Company—that was the Company he alluded to—had their *expediente* charges reduced or taken away, was by representations made by the Manager of the Company to the President, and, through him, a recommendation that these duties should not be enforced. He did not know whether the Board had taken that course, or had gone wrong by omitting to do so. The Chairman gave the Shareholders to understand at the last meeting that they were not going to lay down any more pipes at present, as they considered that the Company ought not to pay those duties which the Brazilian Government enforced. Was it not something to consider why one Company, whose concession was very much the same as this Company's, should be able to have their duties remitted, while this Company had been unsuccessful, notwithstanding that they had spent a large sum in sending out some one specially to Rio to endeavour to have them taken off? He, as a Shareholder, had no object in coming there except that the best might be done with the Company's property, and that he might get as good a dividend as the Company could pay him. £870 was a very large sum to spend, and he asked if that was the money paid to Mr. Kilkeary for his services.

The CHAIRMAN: Part of it—£292 10s.—was paid to Dr. Portella, and £577 10s. to Mr. Kilkeary, but he was not sent out exclusively in respect to this matter, but also with regard to the defalcation question.

Mr. PENNY said he had not forgotten that the Company had received from somebody £500 on account of this defalcation—it might be called this robbery—and they paid £500 to Mr. Kilkeary for examining into it, so that the Company had lost the whole of the £2000 in question, and the £870 seemed also to have been spent in vain. There was, however, a right way of treating this matter, and he hoped the Company, if they could verify what he had said, would go about it in a proper manner. He did not imagine that they would get back this £8000, but he spoke in reference to the future. If they instructed the Manager to deal with this business in the proper way, and get the President to send in his application and back it with his recommendation, the probability was that for the future they would be able to send their goods into the country without an *expediente* and without duty. That was his strong impression. As regarded their returns, he found that they were as nearly as possible on all fours with the accounts put before them at the last meeting; but he should have thought that, as there was 12 per cent. leakage instead of 15, the accounts would have been a little better. He would suggest, too, whether it would not be more satisfactory if the report of the Directors or the statement of the Chairman gave them half year by half year the quantity of coal used and gas made—matters which the gentlemen present were quite capable of appreciating, and he believed that kind of statement would act, if it were known that it would be made, as a spur to the Manager to do the best he could in regard to that very important department, the retort-house, where their profits were made or lost.

Mr. A. F. WILSON thought that any sensible man who had had any experience, not only in the Brazils, but in other foreign countries, knew that it was of very little use to spend money in trying to get back money that was due from them. He thought, with respect to the £9000, that it was a waste of money to go to any expense in trying to get it back, and in attempting to recover it they were putting themselves in a bad position with regard to the future. It seemed to him that as other gas companies did not pay the customs, if this Company gave up the other question of what was due to them, the Government, if they understood that they Company relinquished this claim, would hear them from simple fairness. The concession, so far as he could understand, was very similar to that of the other Company, who were not paying the duties, and it therefore appeared to him this Company had an unanswerable argument why they should not be charged. He believed that if they gave the Government to understand that they would give up this claim as a compromise on condition, they would gain their object, if they went to work in the proper manner, and that would be very desirable in regard to the future of the Company. Whatever they did, he urged them not to waste money in law expenses in the Brazils. He spoke from experience in other cases. With regard to the report generally, he thought it so far satisfactory that there was no calamity. He had seen so many sad things with regard to this Company, that it was very encouraging to see a half year without any. He asked a question with respect to the £1915 additional investment during the half year.

The CHAIRMAN said it was part of the cost of the increased pipes—pipes that were already sent out.

The SECRETARY said they placed half to capital and half to revenue, and the sum mentioned was the half.

Mr. WILSON thought the stock of coals was very large—larger than the whole consumption of the past half year.

The SECRETARY remarked that they had not enough coal in stock.

The CHAIRMAN said that the Directors had no reason to find fault with any of the observations which had been made—indeed, they were only too thankful that gentlemen took an interest in the concerns of the Company, and brought these matters before them. The Directors had had enormous difficulties to contend with; they had had to find for the new pipes the money which the Proprietors did not find, and they had had to make themselves liable also for large sums of money to lay down those pipes, and he thought they had taken more on themselves than they should have been obliged for the interests of the Company. He believed many directors would have said, "No; if the proprietors do not find the money, let the concern go on as it is, and let the shareholders be content with small dividends;" but they had acted differently, and found the money to lay down these pipes, which had been very beneficial. They had done what Mr. Penny stated—instructed the Manager to appeal to the President to write to the Government, and they had made use of him in every possible way, and yet they had been unsuccessful. He thought, however, if they had abandoned £9000 without a struggle, they would have been open to the greatest reprobation from the Proprietors. With regard to the other Companies, the Pará Company had, he said, got these charges remitted, but how? By sacrificing everything—every halfpenny; and he did not suppose this Company would be any worse off in the end, but notwithstanding all that had been said, he was not disposed to think they would get none of the money back. They did formerly, and might on this occasion, and as a Proprietor he was not disposed to give up £9000. The Shareholders had not found the money for the new pipes, and the Directors would like to see their money back. They were under great liabilities for these matters, and did not wish so readily to give this money up.

The SECRETARY then read the memorial they had addressed to the Baron de Penedo, referred to by the Chairman.

The CHAIRMAN, continuing, said he had stated that the Pará Company had obtained the remission of them by foregoing everything; the Rio Company had enjoyed total exemption after going to law; and the Monte Video Company and the Sao Pedro Company paid everything.

The SECRETARY: One Company pays everything, and the other nothing.

Mr. PENNY thought it fair to state, with regard to the Pará Company, that at the beginning of the year they gave to the authorities there a list of the probable quantity of coals, &c., they might require to import during the year, and the exemption was made year by year. He did not say that the exemption was for ever; but, having once obtained it, the Pará Company believed that the same system would be pursued in the future.

The CHAIRMAN observed that this Company went through the very same process—they had made their requisitions year by year in the very same way.

Mr. FINLAY observed that they had sometimes obtained exemption, but the duties had been imposed again.

Mr. PENNY hoped that they would get exemption again, and if the claim for £9000 was a bar to getting the exemption from these duties in the future, he should say that it would be wise to make the best of a bad job, and give up the claim entirely. He quite admitted the justice of what the Chairman had said—that the Directors had shown much good will to the Company by advancing money to pay for pipes; at the same time he must say that he had never been applied to for an advance. If he had been, he would have responded; but he appreciated all the same the burdens the Directors had taken upon themselves for the benefit of the Shareholders.

Mr. FINLAY thought every one must feel indebted to Mr. Penny and Mr. Wilson for what they had said on this occasion. It would ventilate the question, and throw light on the matter, and, as a member of the Board, he felt personally indebted to Mr. Penny, but he thought that gentleman required to be a little better informed than he was at present as to the Company. As the Chairman had said, everything had been done up to the present that could be done in the interests of the Company, and if the Directors had thought it prudent or desirable to abandon the £9000 if guarantees had been offered that they would be exempt for the future, they might, he thought, rely upon it that it would have been very favourably entertained.

Mr. WILSON held that before giving up such a very large sum as the amount mentioned, the Directors should have the sanction of the Proprietors. That was one reason why he had brought the matter forward, because if there was a general feeling among the Shareholders that it would be wise to make a compromise, and give up the £9000 in the interest of the future, the Directors, for their own advantage, would act on such a feeling.

The CHAIRMAN said that at present the Board knew nothing of the sort—that any such compromise would be made; certainly, it had not yet been shadowed forth to them in the slightest degree, and they were obliged to persist in the claim. He thought, however, that the subject had now been thoroughly ventilated. The Company did make efforts to get some money or debentures at 6 per cent., but they succeeded in getting only £2650, so that an opportunity was offered to the Proprietors to subscribe. He believed it was the practice of companies in England to compare corresponding half years, but Mr. Penny said he would like a different system for the comparison as to coals. In the past half year they cost £2802; to December last, £2843; to June, 1878, £2976; and then—that was the first half year the new pipes began to have some effect—in the previous half the cost was £3400, showing a saving of £500 or £600 by reason of these pipes, and that was the cause of the increased prosperity of the Company. He believed it would be permanent, and if they could complete the whole thing, matters would be still better. They would endeavour to get the duties remitted, and he really thought that they had been treated very harshly. For many years the Brazilian Government had been considered about the most honourable Government out of England, and they expected that that character would be maintained with them.

The motion was then put, and carried unanimously.

Mr. H. BROTHERS said the next business was the election of two Directors, and he had great pleasure in moving the re-election of Mr. Horner. The Directors knew the valuable services that gentleman had rendered to the Company, and the manner in which he conducted their business made it very agreeable to the other members of the Board. Being nearly one of the oldest Directors of the Company, and having some experience in gas matters, he could endorse what the Chairman had said as to the difficulties they had to contend against. So far as the customs duties were concerned, it had been his experience from the first starting that they had had difficulties. Sometimes they had had them remitted, sometimes they had obtained exemption for a year; and he thought, if they could get the £9000 back, they ought to try and do so in the interest of the Proprietors.

Mr. FINLAY seconded the motion, which was carried unanimously.

The CHAIRMAN, in expressing his thanks, remarked that if he had said anything warm it was because he felt warmly in the interests of the Company. They certainly thought they had shown their interest in the Company by having gone out of their way, as he stated, to serve it. It was

their desire to do the very best they could, and he had not the smallest doubt that next time, unless something unforeseen happened, it would be more worth the Shareholders while to attend than it was on the present occasion.

Mr. FINLAY then proposed the re-election of Mr. Arthur J. King as a Director.

Mr. HODGE seconded the motion, and it was carried unanimously.

Mr. KING, after expressing his obligations for the honour done him, congratulated the Shareholders on the improvement which the accounts exhibited. That fact could be evidenced by one or two brief references. In June, 1875, before they commenced a renewal of the mains, the rental per ton was £4 16s., while this half year it was £6 0s. 2d. The products at that time realized 10s. 3d. per ton, while now they were 15s. 7d.; so they would see that the large outlay made during the last three or four years had been quite successful; and they were now working at very nearly 10,000 feet per ton of coal, with a leakage of 12 per cent. instead of 30. Therefore, with the very good price they received for their gas, they were bound to reap very satisfactory results, as would be seen by the balance-sheet; for, although they were only able to declare a dividend on the ordinary shares at the rate of 4 per cent., and carry a little more forward than they brought into the account, yet the true comparison was not with that, but with the amount to credit on one side—£20,456—and the amount to debit on the other side for their normal expenses—£13,710—all the rest being extraordinary expenses for laying down the new mains. The difference between the two was £6746, and, if they deducted £2125 for the dividends on the preference shares, there would remain £4621 as the balance available, which was at the rate of rather more than 9 per cent. per annum. The extraordinary expenses would not go on for ever—in fact, they were disappearing rapidly, and there remained in the suspense account only £3476 to be liquidated in that connection. That was rapidly disappearing, and when it had gone, the revenue account would assume its normal proportions. Another matter was that the exchange this year had been very much against them. In June, 1875, the rate was 27d., while last June it was 20d. It could not be expected that they would always have such expenses. He thought it only justice at the same time to refer to their Engineer, Mr. Muriel, and state that the present system of mains was the system devised and originated by him. He believed that that gentleman possessed the entire confidence of the Board, for the more experience they had of him, the more satisfied they were that he was an able Engineer, and was realizing all he predicted. With regard to the observations of Mr. Penny and Mr. Wilson, all the points those gentlemen had referred to had been fully considered by the Board. They had made it their business to inquire what the Rio, Pará, Monte Video, and other Companies were doing. For his part, he had not too much faith in the recovery of such a large sum as £8500 from the Brazilian Government, and if he had had individually nothing but his own interest to recognize, he should have said, "Let bygones be bygones, and let us have a clean start;" but having other interests to remember, he agreed with the Chairman that it was not competent for them to give it up till they had exhausted every means to recover it. If they did not succeed, the accounts would be no worse, as that sum was not included among the assets of the Company.

The retiring Auditor (Mr. Joseph Wright) having been re-elected,

A SHAREHOLDER moved a vote of thanks to the Superintendent at Bahia, and to the other Officers of the Company.

The CHAIRMAN said he would second the motion, as it gave him the opportunity of saying how highly he appreciated the efforts of their Superintendent. He knew Mr. Muriel previous to his going out to Bahia, and they needed no better proof of their opinion of him as their Engineer than in adopting his system of main-laying, which had done so much for the Company. He believed that if the mains had been laid in the beginning in accordance with Mr. Muriel's plans, the Bahia Company would have been as prosperous as any Company in the Brazils.

Mr. PENNY proposed that the thanks of the meeting be given to the Chairman for his conduct in the chair, and to the Directors for the able manner in which they had conducted the affairs of the Company. He should leave the meeting with the feeling that the business of the Company was being conducted with a great deal of care and skill. It had been very satisfactory to him to hear what Mr. King had said, because he felt some little doubt as to certain matters, and those doubts Mr. King had removed.

Mr. FOGG seconded the motion, which was carried unanimously.

The CHAIRMAN returned thanks on the part of his colleagues and himself. He hoped the Proprietors would not think that the Board viewed other than in the spirit they ought to, any observations which might be made on the accounts. He thought it was exceedingly desirable that in all these undertakings there should be gentlemen who had the courage of their opinions, and who, having looked into their affairs, would tell the Directors really what they thought. Such remarks tended to keep the Directors alive to their duties. They would do all they could, for their own sakes as well as the Proprietors, for the interests of the Company.

The proceedings then terminated.

ODESSA WATER-WORKS COMPANY, LIMITED.

The Ordinary Half-Yearly General Meeting of this Company was held on Thursday last, at the City Terminus Hotel, Cannon Street—Sir FRANCIS S. HEAD, Bart., in the chair.

The SECRETARY (Mr. Emanuel Allen) read the notice convening the meeting, and the following report was presented:—

The Directors beg to submit the interimaccounts for the half year ending June 30 1879.

A comparison with the corresponding half year of 1878 shows:—

	1878.		1879.
Expenditure at Odessa	£13,704	..	£11,350
Expenditure in London	1,404	..	1,977
	£15,108		£13,327

The water-rents have yielded £22,843 for 1879, as against £17,985 for 1878, and £18,149 for 1877, while the miscellaneous receipts at Odessa, in addition to the above, are £1406 for 1879, as against £1161 for 1878. But the loss from exchange has increased from £1603 in 1878 to £3797 in 1879.

The result of the half year's working is to carry a clear balance of £2804 to the credit of revenue, as against a loss of £2101 in the corresponding period of 1878, being a net improvement of £4905.

The above is, no doubt, to a certain extent, satisfactory, but it is very far indeed from affording a return for the expenditure of this Company in supplying Odessa with water. That supply has contributed in no small degree to the prosperity which the city is now enjoying, though the sewers remain unfinished and unused. The plague has not yet appeared, and in consequence the high death-rate due to preventible causes at Odessa is still disregarded. But the day must come when the necessity for ordinary sanitary and commercial legislation will be apparent to the Russian Government, and the enormous difficulties under which this Company has to struggle cannot then longer be ignored or remain without redress.

In the meantime, the Directors can only repeat that for want of such legislation they have neither power to require a proper use of water, or to obtain fair payment for its supply. They may add that no one of the numerous grievances contained in their list of requirements has been redressed, or even seriously considered by the Government or the Municipality. They hope, however, that with the restoration of peace and quiet the importance of internal improvements may be recognised, and some better encouragement offered to British capital to embark in Russian undertakings than is to be found at present.

REPORT OF THE RESIDENT ENGINEER.

Odessa, Sept. 25, 1879.

To Colonel A. S. Quill, Manager.

Sir,—I have the honour to report for the information of the Board of Directors, that during the half year ending June 30, 1879, the quantity of water pumped to Odessa from the River Dniester amounted to 484,066,615 gallons. The coal consumed for this purpose was at the rate of a little under 2¼ tons per million gallons.

The number of new services laid on during the half year was 102. The number of meters fixed was 237. The total number of meters in work on June 30 was 2927. During the whole of the spring the water of the Dniester was exceptionally muddy, but it was, nevertheless, delivered in Odessa during the entire half year in a perfectly clear condition.

The watering of the streets has been on a very extensive scale, and the quantity of water taken by the Municipality may be estimated at not less than 63¼ millions of gallons (which this Company is obliged to supply gratis).

It has been necessary to thoroughly overhaul the engines at the Dniester and in Odessa, as also the line of telegraph, and to renew the sand in two of the filter-beds. With a view to all possible economy, this has chiefly been carried out with the staff of the Company in Odessa and at the Dniester.

WALTER BRADBURY, Resident Engineer.

Capital Account, for the Half Year ending June 30, 1879.

Expenditure.				*Receipts.*			
Capital expenditure to Dec. 31, 1878, as per last accounts	£953,393	10	6	A shares preferred—30,000 shares of £20 each	£600,000	0	0
Less repayment on account of property relinquished	135	2	8	B shares deferred—12,472 shares of £20 each	249,440	0	0
	£953,258	7	10	Debenture bonds	137,350	0	0
Balance carried to general balance-sheet	40,520	12	2	Debenture stock, 5 per cent.	6,989	0	0
	£993,779	0	0		£993,779	0	0

Authorized share capital—
A shares preferred, 30,000 of £20 each £600,000 0 0
B shares deferred, 12,500 of £20 each 250,000 0 0
£850,000 0 0

Dr.—*Revenue Account, for the Half Year ending June* 30, 1879.

To Expenditure at Odessa—			
Salaries and wages at Odessa and Dniester	£4,546 13 1		
Coals	3,048 9 1		
Stores, maintenance of works, and general working expenses	1,625 2 9		
Expense of water sales, &c.	469 13 3		
Rents, rates, and taxes	357 2 4		
Office expenses, stationery, fire insurance, travelling expenses, &c.	870 12 3		
Law charges	433 1 3		
		£11,350	14 0
Expenditure in London—			
Directors and Auditors fees	£676 5 0		
Salaries of Secretary and Clerks	390 0 0		
Rents, rates, and taxes	180 6 8		
Law charges	402 17 4		
Miscellaneous charges, printing, and advertising	104 19 3		
Mission to St. Petersburg	222 15 9		
		1,977	4 0
		£13,327	18 0
Less by exchange on salaries and remittances from Odessa		3,797	11 10
Interest on debenture bonds and 5 per cent. debenture stock issued		4,327	11 4
Balance carried to balance-sheet		2,804	13 4
		£24,257	14 6

Cr.—*Revenue Account.*

By Water-rents	£22,843	6 7
Miscellaneous receipts	1,406	15 5
Transfer fees	7	12 6
	£24,257	14 6

Dr.—*General Balance-Sheet.*

To Sundry outstanding accounts		£1,121	9 6
Interest accrued on debentures and debenture stock, and provided for		1,808	10 1
Debenture interest outstanding, including income-tax unpaid		472	11 3
Deferred dividend warrants issued, less portion converted into 5 per cent. debenture stock		7,953	11 10
Capital account, balance at credit thereof		40,520	12 2
Revenue account—			
Balance at credit per last accounts for half year to Dec. 31, 1877	£4,714 15 9		
For half year to Dec. 31, 1878	1,409 7 6		
		6,124	3 3
Balance for half year to June 30, 1879		2,804	13 4
		£60,805	11 5

Cr.—*General Balance-Sheet.*

By Cash at Bankers in London		£875	9 0
Ditto on deposit		1,800	0 0
Cash to meet debenture coupons unpaid		472	11 3
Cash at Bankers and in hand at Odessa		796	16 10
Remittances in transit		5,000	0 0
Bills receivable on hand		202	14 2
Stocks on hand at Odessa—			
Fixed meters	£14,529 10 8		
Tools, horses, and carts	1,376 2 2		
Pipes and general stores	16,653 13 3		
		32,559	6 1
Stock of coals at Odessa		6,210	3 8
Office furniture and leases in London and Odessa		1,779	11 1
Sundry debtors		4,694	1 0
Expenditure in suspense, as per previous accounts		6,423	18 4
		£60,805	11 5

The CHAIRMAN, in moving the adoption of the report and accounts, observed that there were two or three items which required explanation. The sum of £5700 in debenture bonds had been paid off this year as the bonds fell due, and they had to pay it out of funds in hand. Passing to the revenue account, the item of coals appeared as £3048, as compared with £5359 in the corresponding half year—a large diminution, owing to the termination of the war, which had enabled them to buy English coals at lower prices than those previously used. Another item in the Odessa expenditure was that of office expenses, stationery, &c., which amounted to £870, against £542 in the corresponding half year. That arose chiefly from a claim which was made against them when they left their old offices, for damages to the premises, and it was placed at £357. They had been obliged to pay that amount under an order of court, but they had appealed against it, and they hoped to be successful in voiding the payment. In the meanwhile, they had charged it against revenue as it fell due. But for that item there would have been no increase whatever, but,

on the contrary, a slight decrease. The total London expenditure was larger than it was last year, arising chiefly from the law charges, which were £402, against £115 in the corresponding half year. That was the result of their action with regard to Mr. Schwaben, which he told them last year would in a few days be settled satisfactorily to them. But he was sorry to say that Mr. Schwaben had succeeded in procuring an adjournment, and had also asked that a commission should be appointed to go to Odessa. They had appealed against that, showing that there was no justification for it, and consequently it was reversed in their favour. Although the matter had been further delayed, he had hoped that it would have been settled before this meeting; but Mr. Schwaben had made application for further postponement. However, the Arbitrator had peremptorily ordered the matter to come on on the 11th, and he (the Chairman) hoped it would then be finally settled. The extra law expenses were thus unavoidable, unless—and he supposed no one would recommend such a course—they consented to pay a claim which they disputed. Miscellaneous charges had amounted to £104, against £87. Another item was the mission to St. Petersburg, which amounted to £222, and he thought the money had been well spent. Those items explained the increase in the London expenditure. The next item, he need hardly remind them, was one over which the Directors had no control—namely, the loss by exchange, which amounted to £3797, against £1602 in the previous year. On the other side, they gave the amount of the stocks in hand at Odessa —£32,000. In connection with this he would observe that the fixed meters were absolutely necessary for the proper conduct of their business, to let them know what water was used, and to act as a check on very objectionable proceedings. They had hitherto been obliged, in order to pay their working expenses, to use dividend warrants instead of paying cash, and therefore the necessity arose of meeting those warrants. He explained this matter because he had been asked questions on the point. The simple fact was that they had not in hand sufficient capital for their working expenditure, but they hoped that as they became more prosperous they would be able to raise money on fairer terms. He hoped that public confidence in the undertaking would increase, and that people would see that the 6 per cent. debentures were a good investment, and that thus they would have a sufficient number of debentures taken up. That would depend upon their general position. They would then be able to pay the deferred dividend warrants. At present, however, the Board were powerless in the matter. With regard to the second paragraph in the report, the returns showed that since the end of the last half year there had been a continued increase in the water-rents, and the receipts for the months of July and August showed an increase of about £2000 over the corresponding months of 1878. Thus the inhabitants evidently took an increased quantity of water, but they did not by any means use what they should do, in the interests of the city and of every sanitary and cleanly consideration, as well as of their personal comfort. But to some extent the Company were profiting, as he might say, in spite of the inhabitants. He was very careful not to raise any undue expectations, nor to rely upon any apparent prosperity, but this increase was shown, notwithstanding all the disadvantages under which the Company were labouring. The Directors had observed in the report that the accounts were very far indeed from indicating a return for the expenditure the Company had incurred in supplying water. The sewers remained unfinished and unused. He had formerly explained how desirous they were that the sewers should be completed, because their completion would not only be of great benefit to Odessa generally, but would largely increase the requirements of the city for water. But, although the sewers were unfinished, he could say that the works were not stationary, as during the last few months some progress had been made, though more ought to have been done. The plague had not appeared, and in consequence the city death-rate due to preventible causes was still disregarded. That was the honest and plain truth. When the people were alarmed about the plague, there was a very considerable stir about sanitary arrangements, and it looked as if the Authorities were going to have these matters taken in hand; but no sooner did the alarm cease than the excitement as to sanitary arrangements, which ought to be independent of any such fear, ceased also. He was glad to say that since the report had been published he had received from the President of the Medical Society at Odessa a translation of an address delivered by that gentleman at the annual meeting of the Society last month, and this was curiously corroborative of what the Directors stated in the report. That gentleman also said that it was not surprising that the mortality of the city stood at 35 per 1000, while it seldom exceeded 25 per 1000 in other European cities. Not several hundreds, but tens of thousands of children died annually, without any plague or epidemic. The sanitary arrangements, continued the account, were confined to rejecting refuse and clearing out water-closets. Dead bodies, in a state of decomposition, might be seen in open vaults, and in the centre of the town piles of putrid matter were to be seen. These remarks were made by a medical man in Russia. He need scarcely remind them that people there were careful before they spoke out, and they might, therefore, conclude that the state of things was far worse than that described. He (the Chairman) felt that not only from these, but from other causes, in Russia as in other countries, the necessity for sanitary arrangements, and for giving water companies like theirs those powers which are essential to public health and civilization, would sooner or later be recognized by the Russian Government. He need not tell them that until quite recently there had been but one thought in Russia—that connected with foreign wars; but at the present moment those who paid any attention to Russian affairs were of opinion that before long a change must inevitably occur in the internal government of the country; and when it did occur, he hoped that there would be a Minister who would see that not the least among many other crying evils was the lack of sanitary arrangements. When that change occurred, he did not think it possible that the position of their great Company, which stood first among joint-stock companies in Russia, could be overlooked. In the meanwhile they must live in hope that the rights of the Company and the interests of the country generally would eventually be recognized. He also hoped that some greater inducement would be held out to British capital to embark in Russia than was now offered. The Company had for a number of years supplied the third city of the Russian Empire with water, but they had received no sort of advantage in return. They owed 380,000 roubles to the Odessa Municipality for money advanced, and which they had to pay out of their earnings. They had supplied the city for nothing, and they were indebted to the amount he had stated for having done so. How could the Russians expect English capital to be embarked further? Personally he had received nothing but courtesy from Russian officials, and the higher the men, the more they sympathized with the Company's position. But in the present state of the Russian law, and with their contract standing as it did with the Municipality of Odessa, the officials were powerless to give them assistance; and the only point from which he looked for improvement was the change in the internal government to which he had alluded, and which he hoped would culminate in improved sanitary regulations. Till then they would not be in a position to do justice to the work they had to perform; and when that time arrived he hoped they would receive a fair remuneration.

The motion having been seconded,

A Shareholder observed that he always appreciated very highly the remarks made by the Chairman at their meetings, but the fact was that they never reached the ears of the persons who could affect their position. He therefore hoped his observations would be published in the Russian papers. It was only by continual outcry that they could reach the Municipality of Odessa or the Russian Government.

Several other Shareholders having spoken,

The Chairman replied *seriatim* to the observations made. With regard to their coal, the Company found that the best for their purpose was Welsh steam coal. Knowing the difficulty of obtaining it, they did not think it advisable to invite public tenders, but they procured tenders from three or four persons who really had the best coal, and the result was that they obtained a good coal at 8s. 9d. per ton. With regard to having his observations inserted in the Russian papers, the Board had done what they could; but, as the meeting were aware, that was by no means an easy thing to accomplish. Still, they had met with some success, and he believed what they had done would have a beneficial result. He had, he said, been taunted with not having improved the Company's position. The policy which he had pursued was perfectly free and open, and he was quite sure that, as far as was practicable, it had not been without effect. The fact was, Odessa was a large commercial city, inhabited not only by Russians, but by Jews, Turks, &c., congregated there for trade; and it required great care and management on the part of the Company's servants to prevent harassing complaints of, and claims upon the Company. With respect to their late Manager in Odessa, Mr. Michell, whose services had been impugned, as that gentleman was no longer in their employ, he did not wish to revive any discussion as to his management. But before he (the Chairman) had anything to do with the Board, Mr. Michell had *carte blanche*. However, he made no progress. Mr. Michell had been all his life in Russia, and if he did not succeed, he (the Chairman) did not think other people would. In their present Manager he thought they were singularly fortunate. He had carried out the instructions of the Board, and had conducted the business of the Company in a most satisfactory manner. Complaints had been made of the difference between the estimated and the actual cost of the works, and it had been said that the services of the Engineers, Messrs. Quick and Son, ought not to be retained. As to the part they took in originating the Company, he knew nothing; but he did know that Messrs. Quick had declined to receive any remuneration, although they stated that if they could render any service to the Company, they would be happy to do so. The Company had benefited by their advice, and they had received nothing for it; and he thought that Messrs. Quick, in pursuing this course, had done what was creditable to themselves and useful to the Company. The Directors had from time to time succeeded in making very considerable reductions in the expenditure, and he did not consider that they had yet come to the end of them; but they were obliged to be very careful, owing to the onerous terms of their contract. They were liable to penalties if anything went wrong; and they had, consequently, to keep a larger staff than they otherwise would. However, he did not despair of being able, to some extent, to effect a further reduction. With regard to the payment for water supplied to troops, he expected that payment would be made shortly. The matter had been pressed, and was being pressed on the attention of the Russian Government; but he had already been charged with complaining too much of Russia, and he did not desire to say more than was necessary.

At the conclusion of the Chairman's reply, several Shareholders again animadverted strongly on the position of the Company, one gentleman observing that a clause in the original prospectus stated that the Municipality of Odessa, recognizing the advantages of a proper supply of water, guaranteed to the Company a minimum of 328,500 roubles per annum—that was about £45,000. That clause, he said, induced him to take shares in the Company. What, he asked, did the word "guarantee" mean? Yet it now appeared that it was a repayable loan.

Mr. Northover deprecated going back to the past. He supported the Board, and said the best thing the Shareholders could do was to wait.

The Chairman, in replying generally to the remarks, said with reference to Messrs. Quick it was no uncommon thing for engineers estimates to be exceeded. He would, however, address himself to the direct question why they retained those gentlemen as Consulting Engineers. He had told the Shareholders that the Company were much indebted to them for advice, but, in addition, Mr. Joseph Quick had been to the works at Odessa, and he possessed a knowledge of them which was very valuable. If they had another man, who would scarcely be as well acquainted as he was with their affairs, they would have to pay him heavily. It therefore appeared to him that it would be unwise to dispense with Mr. Quick's services.

The report and accounts were then adopted unanimously, and the customary vote of thanks to the Chairman and Directors concluded the proceedings.

LEEDS CORPORATION WATER SUPPLY.

Opening of the Fewston Reservoir.

In the Journal of the 7th ult., we noticed the ceremony in connection with the commencement of the Eccup reservoir, and we have now to record the opening of the Fewston reservoir by the Mayor (Alderman Addyman), on Monday, the 3rd inst.

Alderman Croft, the Chairman of the Water Committee, in presenting a gold key with which to unlock the valves, said they all had good reason to be much pleased that so extensive an undertaking had been completed, and that the whole of the works of construction carried on for ten or twelve years past had been without serious mishap or accident to life.

The Mayor, having unlocked the valves and commenced winding up the sluices, said that the value of the great work which was now practically completed would be felt and appreciated by many generations yet to come; and, in referring to that work, he desired to acknowledge heartily how important a part in the origination of it had been taken by the former Chairman of the Water Committee (Mr. R. M. Carter), whom he was glad to see present. One important and noteworthy point was that such extensive and costly works should have been carried out without the townspeople being required to pay even a penny rate for them. The revenue derived from the consumers of the water sufficed not only to pay interest upon the capital expended on the works, but also to leave a large surplus. The ratepayers had not been required to contribute one farthing, but were enabled to buy the best of water at such an extremely cheap rate that a poor man could have a ton of it conveyed to his house for the small sum of ¾d. From a social, sanitary, and manufacturing point of view, such an abundant supply of pure water was of the utmost importance to a great town like Leeds. He then read the following short history of the works, the particulars for which had been furnished to him by the Engineer of the works, Mr. E. Filliter:—From the year 1694 to 1841 Leeds was supplied from the River Aire, near Leeds Bridge. The Leeds Water-Works Company obtained their Act in 1836, and constructed reservoirs and other works at Eccup, Weetwood, and Woodhouse, which are now in use, and when extended in 1847 to Stubhouse Beck, these works were capable of yielding only about 1 million gallons per day. In 1852 the Company procured an Act of Parliament empowering them to pump an additional supply of 2½ million gallons per day from the River Wharfe at Harewood

Bridge, and to sell their works to the Corporation. Accordingly, in November, 1852, the Corporation purchased the works from the Company for £225,730, and still continued to supply Leeds with water from Harewood Bridge. The consumption of water was then about 1½ million gallons per day. In 1855 the pumping works were transferred from Harewood Bridge to Arthington. In 1860 the Corporation constructed pumping works at Headingley and a reservoir at Bramley, to supply the high-level district—namely, certain portions of Bramley, Farnley, Upper Wortley, Armley, Headingley, Moortown, and Chapeltown, which are above the level of supply from the Weetwood and Woodhouse reservoirs. The consumption of water in the borough at this time was from 2½ to 3 million gallons per day. In 1861 a portion of the Weetwood reservoir was converted into filter-beds, and from this time the Corporation have continued to filter all the water supplied to the town. In 1867 the consumption had exceeded 5 million gallons per day, and the Corporation obtained parliamentary powers to construct the Lindley Wood, Swinsty, and Fewston reservoirs on the River Washburn. In 1877 the Corporation obtained parliamentary powers to construct the Eccup reservoir. The Lindley Wood reservoir was commenced in August, 1869, and finished in November, 1875. It will hold about 750 million gallons, and has cost about £199,000. The Swinsty reservoir was commenced in February, 1871, and finished in January, 1877. It will hold about 960 million gallons, and has cost about £163,000. The Fewston reservoir was commenced in July, 1874, and is not yet finished. It holds about 870 million gallons, and has cost about £147,000 up to the present time, and is expected to be finished before the end of the present year. The Swinsty reservoir, from which the supply is gravitated, is about 16 miles from Leeds, as measured along the course of the conduit-pipes, or about 13 miles as the crow flies. Two 30-inch mains convey the water from Swinsty to Eccup, whence it flows through a tunnel under Black Moor, and thence by a 40-inch pipe to the filter-beds at Weetwood. It is distributed to Leeds by a 30-inch and two 18-inch pipes. The total cost of the water as conveyed and delivered to consumers in Leeds is, as nearly as possible, the small sum of 1½d. per ton. The land for the enlarged Eccup reservoir has been purchased under the arbitration before Sir Henry Hunt, and the men and materials are being removed from Fewston in order that this work may be begun. It is hoped that it may be finished in three or four years at the outside. It is intended to hold 1400 million gallons of water for the supply of Leeds. This is more than six months storeage of the present consumption; and as the water will enter in a regulated quantity at one end, and be drawn out at the same rate at the other end, it is anticipated that the purity will be much increased by slow deposition during so long a period.

In the evening those who had been present at the ceremony dined together at the White Horse Hotel, Otley—Alderman Croft in the chair.

The Mayor, after the usual loyal toasts, proposed "Success to the Leeds Water-Works Scheme," coupled with the name of the Chairman of the Water Committee.

Alderman Croft responded. He said that the depth of water in the reservoir was just now only 26 or 27 feet instead of 47 feet, which would eventually be its depth. This limited to some extent the appearance which it would present when full; but after all they might be thankful for the circumstance, since it was owing to the want of rain for two or three weeks past, and the fairer weather, that the farmers in the valley had been enabled to get in their later crops more safely than would otherwise have been the case.

Mr. T. Hawksley, the Consulting Engineer, was also called upon to respond. He said he spoke with mingled feelings of satisfaction and regret—satisfaction that the great work upon which, in conjunction with his able and esteemed friend, Mr. Filliter, he had been engaged for a number of years was now drawing to a successful completion—regret that the very agreeable professional connection which he had so long enjoyed with the Corporation of Leeds was now coming to its natural termination. He congratulated the town upon having a great system of water supply, which could scarcely fail to be a source of blessing and prosperity for many generations to come. He was glad to know that the one deficiency, that of storeage accommodation, was about to be well supplied by the reservoir which was already commenced at Eccup.

Mr. Filliter was likewise called upon to respond, and expressed the keen interest which he would continue to feel in the welfare and success of their splendid system of water-works. In regard to the important question of finance, he remarked that as the capital would have to be paid off at a somewhat rapid rate during the next generation, it was probable the Committee might have to raise the rates for water during the next few years, until the natural increase of income from all sources met the large charges that would be thrown upon them by the provisions of their last Act of Parliament.

Mr. D. Bruce Peebles on Economy in the Consumption of Gas.—On Monday evening, the 3rd inst., Mr. D. Bruce Peebles, of Edinburgh, gave an account of his patent needle governor gas-burner to the members of the Edinburgh Association of Science and Art, and demonstrated its efficiency in ensuring the economical combustion of coal gas. Beginning with the production of gas in the retort, and illustrating the process of gas-making, he brought under notice the deleterious influence of pressure in the first stage of the manufacture, and the waste which takes place when pressure in the mains is not sufficiently controlled. He then described the different kinds of gas-governors in use, and also his patent governors for gas-works and consumers. His new forms of gas globes were shown in conjunction with the new burners, and the remarkable beauty and steadiness of the flames were much admired. A number of the members, in the course of the discussion which followed, expressed surprise that this invention was not better known.

Hull Public Lighting.—It may be remembered that, at a meeting of the Gas Inquiry Committee of the Hull Town Council, on Thursday, the 9th ult., the members were evenly divided as to the desirability of recommending the Council to give instructions for the introduction of a Bill in the next session of Parliament, to enable the Corporation to light by electricity the streets of the borough. It was, however, resolved to submit the question at the next meeting of the Council. This was held on the 30th ult., when Mr. Elam moved a resolution to the effect that the Parliamentary Committee be authorized to give notice for a Bill to enable the Corporation to acquire the necessary powers in order to carry out the lighting of the streets of the borough by electricity. Mr. Hodge seconded the motion. Mr. Larard proposed the amendment that he had moved in Committee, viz.—"That the information obtained with reference to the cost of lighting streets by electricity does not justify the Council to take steps this session to obtain parliamentary powers for lighting the borough, as suggested, they being of opinion that, by waiting some time, further information may be obtained as to the cost and development of electric lighting." Mr. Laverack seconded the amendment, which on a division was lost by 14 votes to 35. Mr. Larard afterwards gave notice of his intention to move, at the next meeting, that the resolution of Mr. Elam, which was carried, be rescinded.

ABERDEEN CORPORATION GAS SUPPLY.

As mentioned in our "Trade Notes from Scotland" last week, on Wednesday, the 29th ult., the Gas Committee presented to the Town Council of Aberdeen an abstract of the accounts, for the year ending Sept. 30, in connection with the gas-works. From these it appears that the amount to the debit of capital account was £135,216 12s. 3½d., made up as follows:—

Expenditure to Sept. 30, 1878	£136,313	16	5½
Ditto to Sept. 30, 1879	5,040	6	6½
	£141,354	3	0
Less depreciation and contingent fund	3,837	10	8½
	£137,516	12	3½
Less amount of sinking-fund applied in paying off borrowed money	2,300	0	0
	£135,216	12	3½

Of this amount, £114,933 13s. 11d. is represented by the gas annuities; £20,200 being borrowed on mortgage, and the balance, £82 18s. 4½d., carried to account. The profit and loss account, which is as follows, shows a balance of £8021 12s. 1½d. carried to net revenue account to meet annuities, interest, &c.:—

Dr.—*Profit and Loss Account for the Year from Oct. 1, 1878, to Sept. 30, 1879.*

To Manufacture of gas—						
Cannel coal			£25,064	17	2	
Purifying materials			751	5	2	
Salary of Superintendent			450	0	0	
Wages of stokers and labourers			4,475	4	4	
Horse and stable account			236	2	9	
Maintenance of works and plant (including renewal of retorts), apparatus, utensils, and labour—						
Materials	£1312	10 0½				
Wages	397	7 7				
			1,709	17	7½	
						£32,737 7 0½
Distribution of gas—						
Wages of Meter Inspectors			£603	15	0	
Repairing, renewing, and refixing meters—						
Materials	£346	2 1½				
Wages	278	19 0				
			625	1	1½	
Repair, maintenance, and renewal of main and service pipes, and laying, paving, and labour—						
Materials	£325	10 0				
Wages	250	3 6				
			575	13	6	
						1,804 9 7½
Rents, rates, and taxes—						
Rents and feu duties			£117	1	5	
Rates, assessments, and taxes			1,647	10	3	
						1,764 11 8
Management—						
Salaries			£613	14	8	
Stationery, printing, and advertising			145	18	8	
Incidental charges			185	17	0½	
						945 10 4½
Discount on gas and bad debts—						
Discounts			£811	1	9½	
Bad debts			383	11	10	
						1,194 13 7½
Amount transferred to depreciation, including £650 to a contingent-fund—						
On works and pipes			£1,228	10	1	
On meters			609	0	7½	
						1,837 10 8½
						£40,284 3 0½
Balance carried to net revenue account to meet annuities, interest, &c.						8,021 12 1½
						£48,305 15 2

Cr.—*Profit and Loss Account.*

By Gas and meter rents				£44,066 12 6
Residual products—				
Coke	£482	15 10		
Tar and ammoniacal liquor	3,748	16 10		
			4,231	12 8
Transfer fees			7	10 0
				£48,305 15 2

THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.

Result of the Poll of Owners and Ratepayers.

The voting papers, which were distributed throughout Liverpool in order that the owners and ratepayers might be enabled to express their concurrence with, or dissent from the Corporation in their resolution to promote a Bill in the next session of Parliament to carry out the Vyrnwy scheme for the better supply of water to the borough and out-townships, were collected on the Monday of last week; and on Tuesday it was formally announced that, by a majority of 2660 votes, the promotion of the Bill was agreed to.

It may be remembered that at the special meeting of the Town Council, held on the 6th ult., the motion to proceed with the scheme was agreed to by a majority of 33 votes to 13; but at the town's meeting, subsequently convened under the provisions of the Borough Funds Act, by a considerable majority—said to be 2 to 1—this resolution was rejected. A poll was demanded on behalf of the Corporation, and has resulted as above stated.

More than 70,000 voting papers were delivered, and, as some of the owners and ratepayers, according to the extent of their property, had as many as six votes, these papers represented about 100,000 votes. Not one-half of them were returned with effective votes recorded, only about 29,000 of the papers being allowed in the counting, representing 41,288 votes, distributed as follows:—

Parish and Township.	No. of Districts.	No. of Voting Papers.	Votes For.	Votes Against.
Parish of Liverpool	97	12,330	10,566	9,995
Township of Everton	35	5,683	3,688	3,035
Township of Kirkdale	11	2,268	1,596	1,226
Township of West Derby	25	3,608	2,098	2,062
Township of Toxteth	29	4,657	3,507	2,515
	198	28,546	21,455	18,853
Doubtful votes allowed	..	..	519	461
Total	..	..	21,974	19,314

This shows a majority of 2660 votes in favour of the resolution of the Council to proceed with the scheme.

ON THE OXIDATION OF SULPHUR IN GAS BY COMBUSTION.

By Mr. W. C. Young, F.C.S.

[From the *Analyst*.]

In No. 8 of the *Analyst** I published an account of some experiments made for the purpose of ascertaining whether sulphurous or sulphuric acid was produced by the combustion of gas containing sulphur, the results of which led me to the conclusion that practically the whole of the sulphur present was converted immediately into sulphuric acid. This conclusion was afterwards borne out by Messrs. Silliman and Sadler, in a paper "On the Volumetric Determination of Sulphur and Ammonia in Illuminating Gas," which appeared in the Journal of Gas Lighting, Vol. XXIX., pp. 423 *et seq.*, and subsequently by Messrs. Heisch and Wigner. Having this conviction, it seemed to me possible to absorb the acid fumes by passing the products of combustion over zinc in a fine state of division, by which means a very simple method of estimating the sulphur would be found, as the difference in weight of the apparatus before or after use would be due solely to sulphuric acid.

In attempting to put this into practice, I was surprised to find that the zinc was quite unaffected, except in places where moisture had condensed, and there sulphate had formed. I noticed, moreover, in the course of numerous experiments, that wherever sulphate was, there also was carbonate to be found. This result casting some doubt on my former conclusions, I determined to investigate the subject further, and avoid using any alkaline or basic substance as an absorbent of the acid. Accordingly, I first determined the amount of sulphuric acid contained in the water condensed in the Gas Referees apparatus, used without carbonate of ammonia before and after oxidation with nitric acid, when I obtained an average of 0·5 grain of sulphur per 100 cubic feet consumed, but in no case did I find an increase when the liquor was boiled with nitric acid previous to precipitation.

As it was possible that the condenser was too hot to admit of the absorption of the acid by the condensed water, I next caused a fine stream of water to flow on to the glass balls in the cylinder by means of a modification of Bischof's constant level apparatus, used in his method of water analysis. A drawing of this apparatus will be found in a paper by me, printed in the Journal of Gas Lighting, Vol. XXIX., p. 464. It consists of an inverted flask, the neck of which is fitted into a tube narrowed towards the end to a fine bore, and fitted near its extremity with a stopcock; on to this tube is blown at right angles another tube bent up again so as to be parallel with the former, and furnished near the top with a stopcock. To use this apparatus, the flask is filled and the tube fitted firmly into its neck, the whole inverted and the lower stopcock opened; when the flow of water ceases, the delivery can be regulated to any desired rate by means of the upper stopcock.

The following results were obtained in this way:—

	Sulphur Condensed as H_2SO_4 in Grains per 100 Cubic Feet of Gas Consumed.	Total Sulphur in Gas in Grains per 100 Cubic Feet.
1	0·90	12·9
2	0·65	14·8
3	0·80	11·9
4	1·26	12·8
5	1·26	15·4
6	1·31	14·6
7	1·53	12·7
8	0·98	13·2

It seems, therefore, that either by using a larger quantity of water, or by cooling the cylinder, the amount of sulphuric acid condensed was somewhat increased, but not to the extent expected, as fully half the space in the cylinder was kept quite cool during the progress of the experiment. The experiment was varied by carrying the end of the eduction-tube of the Referees apparatus into the neck of another cylinder, on to the glass balls in which the water was run, so that the condensing power of the apparatus was vastly increased whilst using the same quantity of water as before.

The results thus obtained were as follows:—

	Sulphur Condensed as H_2SO_4 in Grains per 100 Cubic Feet of Gas Consumed.	Total Sulphur in Gas in Grains per 100 Cubic Feet.
1	1·02	12·8
2	1·01	16·1

A second estimation of the sulphur in the liquor obtained in these experiments was made after oxidation, but no increase was obtained. It was clear, therefore, that the means adopted were inadequate for the purpose of the complete absorption of the sulphur acids formed, but it seemed to me that if only sulphuric acid were formed, these means were competent to arrest it; and to assure the presence of that acid only, I substituted bromine water for the water, using only one condenser, when the following results were obtained:—

	Sulphur in Grains per 100 Cubic Feet of Gas Consumed.	Total Sulphur in Gas in Grains per 100 Cubic Feet.
1	3·28	13·8
2	5·20	12·4
3	8·22	13·1

In these experiments the sulphur obtained as sulphuric acid increased with the bromine water employed, which in the last one was a saturated solution; as, however, a considerable portion of the sulphur had escaped condensation, a trial was made with the double apparatus before described, substituting bromine water for the water, when very similar results were obtained, as will be seen below:—

	Sulphur obtained in Grains per 100 Cubic Feet of Gas Consumed.	Total Sulphur in Grains per 100 Cubic Feet of Gas.
1	7·25	10·60
2	7·32	9·48

It being evident that sulphuric acid could be absorbed from the mixture of gases by means of water, the inference drawn from the failure to obtain the whole of the sulphur was that the remainder escaped in the form of sulphurous acid, the means employed not being sufficient to oxidize the whole. Accordingly I again varied the experiment by placing bromine under water beneath the burner, dispensing with the dripping apparatus, and substituting a reservoir of bromine under water in the upper cylinder, formed by removing the tube in the bottom and plugging the hole. In this way I obtained more sulphur in the form of sulphuric acid, per 100 cubic feet of gas consumed, than was given by the method employed for estimating the total quantity of that impurity in the gas, as will be seen below:—

	Sulphur as H_2SO_4 found by Experiment as above described per 100 Cubic Feet of Gas.	Total Sulphur in Gas by Referees Method per 100 Cubic Feet.
1	14·2	12·5
2	13·8	12·4
3	12·5	11·3

* See Journal, Vol. XXIX., p. 130.

As some of the sulphur obtained may have been derived from the vulcanized rubber connections employed in these experiments, they were repeated, cork being substituted for the rubber, when the results obtained were practically the same as those given by the usual method of estimating the sulphur. Repeat of last experiment, cork connections substituted for vulcanized rubber:—

	Sulphur as H_2SO_4 in Grains per 100 Cubic Feet.	Sulphur by Referees Method in Grains per 100 Cubic Feet
1	13·00	13·4
2	9·28	9·2
3	13·20	13·3

These results show beyond doubt that sulphurous acid only is formed when gas is burned in a Bunsen burner under the Gas Referees apparatus, as the small quantity condensed as sulphuric acid by water alone may reasonably be assumed to have been oxidized during its passage through the apparatus. It is remarkable, however, that in all the experiments I have made where alkali or alkaline carbonate was used as the absorbent, no trace of sulphite could be detected; that sulphurous acid cannot be detected in the water condensed in the cylinder, by the ordinary tests; and that when the cylinder is packed with zinc or copper turnings, the whole of the sulphur is arrested, the resulting compound being invariably sulphate. This is especially so in face of the circumstance that the air in the apparatus was found to contain, on an average, only 12 per cent. of oxygen when the gas was burning at the rate employed, which was 0·5 cubic foot per hour; but if any doubt could have remained as to the power of the current of hot air to oxidize the alkaline and other sulphites formed (by the action of sulphurous acid on carbonate of zinc or copper), the result of the following experiment must have entirely removed it:—An alkaline solution of sulphite of soda, containing the equivalent of 5 per cent. of sulphur, was slowly run on to the glass balls in the cylinder of a Gas Referees sulphur apparatus, the flame of a small spirit lamp being employed in the place of a Bunsen burner to produce the current of air, when it was found that the whole of the sulphite was oxidized into sulphate before it reached the bottom of the apparatus.

THE LANCASHIRE COAL AND IRON TRADES.

(From our own correspondent.)

There is generally a firmer tone throughout the coal trade of this district, and for the better classes of round coal higher prices are being obtained. Apart from the Manchester district, there has been no general specified advance in prices; but at most of the Lancashire collieries more money is now being asked for the better classes of round coal suitable for house-fire purposes, and there is little doubt that prices will move upwards before the close of the month. For best Wigan Arley, at the pit mouth, 9s. to 9s. 6d. per ton is now being obtained, with common sorts ranging from 6s. 6d. to 7s. 6d.; and good Pemberton four-feet, 6s. 6d. to 7s. per ton. The lower classes of round coal are also stiffer in price, as there is an increased demand both for iron-making and steam purposes, and very fair quantities have also recently been going away for shipment. There is, however, still no scarcity of supplies, and ordinary qualities of common Lancashire round coal can be bought at the pit mouth at from 5s. to 5s. 6d. per ton. In other classes of fuel there is no material improvement to report. Burgy is in very poor demand, and, although increased activity in the chemical and salt trades is causing more inquiry for some descriptions of slack, this class of fuel is very plentiful, and, as a rule, no higher prices are being obtained. Burgy, at the pit mouth, is quoted at from 3s. 9d. to 4s. 3d.; good slack at from 2s. 9d. to 3s. 3d.; and common sorts at about 2s. per ton.

For coke there is more active inquiry, but it is only in exceptional cases where any better prices are being obtained.

An agitation for an increase of wages is commencing in some of the Lancashire districts, and a meeting of delegates was held last week, at Wigan, to consider the matter, as well as the advisability of adopting what is known as the "sliding scale" for regulating wages, already in operation in the North of England.

In the iron trade there is only a moderate demand for the raw material, but although there are still some holders who are underselling in the market, makers continue firm at their full rates. For Lancashire pig iron delivered into the Manchester district, quotations are now the same, both for foundry and forge qualities, and range about 53s. per ton, less 2½ per cent., delivered into the Manchester district. In the finished iron trade prices are very firm, and for Lancashire bars delivered into the Manchester district £6 10s. to £6 15s. per ton is now being asked.

The Wigan Coal and Iron Company last week blew in another of their furnaces, making seven in blast out of the ten owned by the Company.

Some of the engineering firms in this district are tolerably busy, but machinists as a rule continue very slack, and there are still large numbers of men out of work.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(From our own correspondent.)

The shipments of gas coals from the Tyne last week were fully an average. Steamers were more at the command of shippers. But there was a difficulty experienced in securing the requisite amount of sailing tonnage to load gas coals, especially for Ireland. About 9s. per ton has been paid small sailing ships to load gas coals for Dublin and Waterford. It can be done again. This is a high rate; but in shipping coals to Ireland exporters have to bear the drawback of not having return cargoes to offer the owners of the vessels. The entire freight has, therefore, to be carried upon the outward voyage. Trade continues to be very busy at the best gas collieries. Second-class pits are also doing well. In fact, the winter trade has been entered upon with considerable vigour. Inferior Durham coal, which came into the market over the past three years as gas, is being taken up for local supply. It is put into the market now as coke, manufacturing, or small coals, as required. The highest rate paid for the very best qualities of gas coals—and contracts have been made upon the basis—is 7s. per ton, less 2½ per cent. discount. Large firms like Messrs. Joicey will not sell a single cargo under that figure; but, in point of fact, the bulk of the contracting has been done by the trade generally at about 6s. 6d. and 6s. 9d. net, with the usual discount. Second-class ranges from 6s. to 6s. 3d., according to quality.

There is a strong demand for coke and coking coals. Better prices continue to be paid for these sorts of fuel. Contracts were made last week, for coking coals, for shipment next season, at an improvement in rates. Manufacturers are offering to contract pretty heavily for a supply of small coals over next year; but the colliery owners cannot see their way very well to do it, lest the miners should demand higher wages, and place them in a difficulty if they should happen to take the contracts too low.

The rates offered on Saturday for sailing vessels to load coals, mostly gas, for the Channel ports were—Teignmouth and Dartmouth 7s. 6d., and Torquay 7s. 9d. per ton. About 6d. per ton more money has had to be paid sailers to load coals for the North of France; 6s. 6d. per ton was

taken by a steamer to load a cargo of gas coals for Hamburg, and, indeed, both for steam and sailing tonnage, rates are higher all round. The money paid on Saturday for small sailing vessels to load fire-bricks for London was 6s. and 6s. 6d. per ton, the latter freight for a vessel to discharge cargo below bridges.

The demand for manufacturing iron is improving. Steam shipbuilding yards, and other trades consuming large quantities of that material, are busier. The great improvement I noticed, in my report of last week in chemicals is strongly upheld. All kinds of chemical goods improved in value again last week.] Manufacturers are about cleared of stocks. The lead trade is very strong. There have been large sales over the past fortnight; the last sale was at £16 10s. common, and £16 15s. refined lead. The timber trade is without change.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

It is specially worthy of mention that the Leith Chamber of Commerce have just elected Mr. John Reid, late Manager of the Gas-Works, as its representative on the Dock Commission. That gentleman's friends in different parts of the kingdom will doubtless feel pleased at this recognition of his special qualifications to deliberate on important matters connected with the trade and commerce of a large seaport.

At the last monthly meeting of the Police Commissioners of Broughty Ferry it was resolved, on the recommendation of the Gas Committee, to continue the price of gas at 4s. 7d. per 1000 cubic feet, with 5 per cent. discount for prompt payment. One of the Commissioners remarked that their gas was more worth the money than that supplied in any other part of Scotland.

On Friday last the Dundee Chamber of Commerce held a meeting for the purpose of electing five members on the Gas Commission. Mr. Alexander Maxwell, while stating that he did not mean to offer himself for re-election, said he had much pleasure in reporting that the gas undertaking was proceeding in a most satisfactory manner. It was increasing its production, and supplying an article giving general satisfaction at a very low price. At present they were not introducing any new plant, and Mr. M'Crae's attention had of late been directed more to the improvement and arrangement of what was already within the works, so as to increase the results and make them more satisfactory. The quantity of gas that had been made continued to increase. Last year there were 322,800,000 cubic feet of gas produced. When the works were acquired in 1868-69, the quantity of gas made was 210,500,000 cubic feet; so that in ten years there had been an increase of fully 50 per cent. in the production. The increase of population and the general growth of trade had to a large extent caused the increase; but there was another reason, and that was that the Commissioners had applied themselves to the judicious re-arrangement of the plant, and had laid out additional capital in a very profitable manner, so as to ensure better and more economical results; and the outcome of this had been that they produced gas at a cheaper rate. At the time the works were acquired the price was 5s. 4d. per 1000 feet, and it was now 3s. 5½d.—a very low price; and the quality was quite equal to what it had been at any time during the ten years or before, and was perhaps altogether free from the noxious impurities which were known to exist in connection with gas. Looking to the state of trade, they did not venture to estimate a very largely increased consumption for the current year; but he was happy to find that, during the summer half of the year now past, the increase had been much beyond the estimate, and by the end of the year he believed they would show an increase quite equal to, if not beyond that of any previous year. In conclusion, he said that after a service of six years, he thought he might ask to be relieved from office, and he had to thank them for the confidence they had so long reposed in him. Mr. Blyth-Martin, another of the Commissioners, stated that he had given some attention to the quality of the gas produced. There were very perfect means of purification, and he did not think there was any purer gas made in Scotland. He had great pleasure in saying that the Commissioners had made very excellent contracts for the supply of coal. He regretted exceedingly that Mr. Maxwell had determined to retire, as he had been of great service to the Commissioners. Messrs. Blyth-Martin, Peter Kerr, Thomas Bell, R. G. Kennedy, and James Lagie were subsequently elected to serve as Gas Commissioners.

Last Tuesday evening Mr. J. D. Cogan, of Bath, delivered a lecture to the Dundee Young Men's Christian Association on "Old Lights and New Ones," in the course of which he traced the progress made in artificial lighting during the last hundred years or so. He showed how the value of gas was determined by means of the photometer, and explained that the illuminating power of the gas made in Scotland was generally equal to the light of 26 candles, while that produced in England was only equal to 16 candles. The lecturer then pointed out the difference between gas and the electric light, and concluded by showing how gas might be used for cooking.

Dr. Littlejohn, Edinburgh, who was lately deputed by the Board of Supervision to examine and report upon the water supply of the city of St. Andrews, has officially passed a severe condemnation upon it, alike as to the quantity and quality available for the community. He urges that the Local Authority of St. Andrews should be called upon to cause a survey of the neighbourhood to be made by a competent water engineer, who should report upon available streams which are as yet unappropriated.

Business was done in the shares of the Edinburgh Gas Company last Tuesday at £45, and in Glasgow Corporation 9 per Cent. Gas Annuities at £215, advancing to £217 on Friday, when Edinburgh and Leith gas shares sold at £31, and Edinburgh Water Annuities at £149.

Last week's Glasgow pig iron market was very animated, and an enormous amount of business was done at rapidly advancing prices. Up to 57s. 3d. cash was paid on Thursday, but on the following day the price declined to 55s. 3d. prompt cash.

The position of the coal market has not changed, and the suspense regarding the wages question is keeping back orders, as buyers are expecting a reduction in prices.

At their meeting on Friday last, the Directors of the Sherborne Gas Company presented the Manager (Mr. T. W. R. White) with £100, as an acknowledgment of his services in the recent alteration of the works—the building of a gasholder-tank, new retort-house, railway siding, &c.

Society of Arts.—The programme of this Society for its 126th session has just been issued. It gives a list of the papers and lectures for the session, so far as they have been arranged. Among the papers to be read at the evening meetings previous to Christmas is one on the 26th inst.—"Suggestions for Dealing with the Sewage of London," by Major-Gen. Scott, C.B., F.R.S. The first meeting of the session will be held on the 19th inst., when the Opening Address will be delivered by Lord Alfred S. Churchill, Chairman of the Council.

Drumcondra Water Supply.—At the meeting of the Dublin Town Council on Monday, the 27th ult.—the Lord Mayor in the chair—Alderman Campbell moved—"That the Town Clerk be authorized to affix the city seal to the deed of agreement with the Commissioners of Drumcondra, Clonliffe, and Glasnevin Township, for a supply of water to the said township, for a rental of 6d. in the pound sterling on the valuation of the houses in the said township, for domestic use of the inhabitants therein, and 6d. per 1000 gallons for all water taken by the Commissioners of the said township for public and fire-extinguishing purposes within the township." The motion was seconded by Mr. Kennedy, and carried unanimously.

Briton Ferry Local Board Gas-Works.—At the monthly meeting of the Briton Ferry Local Board last Thursday—Mr. G. H. Davey in the chair—the Gas Manager (Mr. W. Cheyne) reported that the extension of the works was now completed, that the new tank was thoroughly watertight, and that the new holder was working well. The Chairman said he considered this was most satisfactory, as it was known that the nature of the ground was very bad, and there were difficulties to encounter which might have caused a contractor to give up the work or charge more money. The Board therefore decided to have the tank completed by day-work, under the superintendence of Mr. Cheyne, instead of accepting any of the tenders. Great dissatisfaction was expressed at the time, and it was freely stated that the Board were wasting the ratepayers money. He was now pleased to be able to say that the tank had cost £642 19s. 1d., whereas the lowest tender was £879 13s., and the next £935; so that a saving of £236 13s. 11d. on the lowest, and £292 0s. 11d. on the next tender had been effected, and better work than they would have had by contract. Moreover, by Mr. Cheyne acting as their Engineer, he had saved them over £200 commission, and he was entitled to some remuneration for the extra work he had done. It was resolved that the sum of £60 be given him. On Mr. Cheyne being called in, the Chairman said he had to convey the thanks of the Board to him for the able manner in which he had carried out the work, and he had great pleasure in stating that the Board had resolved to give him £60, not as a gratuity, for it was considered to have been well earned. Mr. Cheyne thanked the Board for their kindness, and said that he was simply performing his duty by doing the best he could in carrying out the instructions of the Board, and he hoped that he would be able to give them the same satisfaction in the future that he had done in the past.

Cromer Water Company, Limited.—An extraordinary meeting of this Company was held on Monday, the 20th ult., to receive a report from Mr. E. Easton, the Engineer instructed by the Board of Directors to report on the state and efficiency of the Company's works and for other purposes. Sir T. Fowell Buxton, Bart., was in the chair. After describing the character of the works, the report discussed the improbability of obtaining an efficient supply of water from them. It then proceeded: The total cost of the works, including the claims made by the Contractors against the Company, but which have not as yet been certified for by the Engineer, amounts, according to the statement furnished to me by the Secretary, to £6055 14s. 9d., of which sum only £4660 17s. 3d. has been paid, leaving a balance still due of nearly £1400. The preliminary expenses have, together with the money expended on works, now all but exhausted the capital of the Company, and it will, therefore, be necessary to raise additional capital before any further works are proceeded with. Under the circumstances there appear but two alternatives to adopt—either to leave the present Company to arrange its affairs in liquidation, and to form a new one under parliamentary powers, which should purchase as much of the plant as will be useful for the purpose; or to raise additional capital among the present Shareholders so as to pay off the existing liabilities, and to provide a further sum which would pay for putting the concern in working condition." After some discussion, it was agreed to adopt the former alternative; and at an adjourned meeting held last Friday, the following resolutions were unanimously agreed to:—1. That the Company be wound up voluntarily. 2. That in the event of the resolution to wind up voluntarily being confirmed at a subsequent extraordinary general meeting, Mr. Edward Raven Priest be appointed Liquidator of the Company. 3. That, if necessary, a petition be forthwith presented to the Court of Chancery for continuing the voluntary winding up of the Company, subject to the supervision of the Court.

The Water Supply of Sydney, New South Wales.—The *Australian Engineering and Building News* states that the Government of New South Wales have determined to proceed with the Upper Nepean scheme for the Sydney Water Supply. Up to 1860 constant complaints were made as to scarcity of water supply, and in 1862 a Royal Commission was appointed to investigate the whole subject, and report thereon. A Commission was engaged 18 months, and recommended that water should be taken from the united Nepean and Cordeaux Rivers, at a point near Pheasant's Nest, some 40 miles south of Sydney. From there that the Cataract River at Broughton's Pass should be reached by a tunnel 4¼ miles long, and a dam formed there by which the Cataract also should be utilized, and the whole brought to Sydney in tunnels, canals, aqueducts, or pipes, as the varying nature of the ground might demand. Also that a large storeage reservoir should be formed in the neighbourhood of Paramatta. The present scheme is substantially that recommended in 1862. From Pheasant's Nest to Sydney the whole country has been contoured, and borings made, thus reducing the estimate of the cost (£1,086,768) almost to a certainty. The drainage area of the Nepean, Cordeaux, and Cataract Rivers above the points from which the water is diverted is approximately 350 square miles, and having sandstone rock formation, and few habitations, yields water as pure as it is possible to have in any country. The storeage reservoir at Prospect, about seven miles west of Paramatta, which is one of the most prominent features of the Upper Nepean scheme, resembles the Yan Yean in Victoria, which has an area of 1303 acres, and a cubical capacity of 6400 million gallons. The Prospect will have an area of 1290 acres, and an available capacity of more than 7000 million gallons. The retaining dam will be 1¼ miles long, and 80 feet high in the centre, holding up the water to 195 feet and 170 feet above high water at its highest and lowest stages respectively. Besides the 7000 million gallons available for distribution, 3000 millions will remain below the 170 feet level, forming a magnificent settling-basin, and preventing any undue rise in the temperature of the water supply. From this reservoir it is proposed to bring the water as far as the valley of Duck Creek, in an open canal, as before. The valley is then to be crossed with an iron aqueduct, and the canal continued to within eleven miles of Crown Street reservoir, with a capacity of 30 million gallons per day. Here there will be a small equalizing reservoir, and the ground falling suddenly for the remainder of the distance, pipes must be had recourse to. It is proposed in the first instance to lay them of 36-inch diameter, with a daily capacity of 8 million gallons, doubling and tripling the pipe lines as may become necessary. Various small reservoirs will be constructed on the route, to supply Ashfield, Burwood, Petersham, Waterloo, &c. The whole length of the conduit is 63 miles, and is made up as follows:—Tunnel, 10¾ miles; open conduit, 34¼ miles; aqueduct, 3 miles; pipes, 13¾ miles; reservoirs, 1¼ miles; total, 63 miles. This may be compared with the principal aqueducts elsewhere, some of which are—New York (Croton aqueduct), 40 miles; Glasgow (Loch Katrine), 26 miles; Aberdeen, 20 miles; Vienna, 57 miles; Paris, 104 miles. Crown Street reservoir, which will be the distributing point, is 141 feet above high water, and commands by gravitation 9-10ths of the city of Sydney. In fact, only a limited area in the neighbourhood of Waverley and Woolahra will be above its reach. This district will be supplied by

pumping, for which the present engine, which was erected in accordance with the recommendation of the 1861 Commission, will suffice for a long time to come. The largest quantity of water ever sent into the city in one day was 6½ million gallons. As the first 36-inch pipe will supply about 8 million gallons per day, and this can be increased as required, it will be seen that an ample supply will be afforded, not only in the present, but for future generations. The Upper Nepean scheme includes the supply of from 6 to 30 million gallons, between Broughton's Pass and Paramatta, for the purpose of irrigation.

Register of Patents.

1534.—Cockey, H., and Cockey, F. C., Frome, Somerset, "*Improvements in wooden grids for gas-purifiers.*" Patent dated April, 17, 1878.

This invention consists in planing the whole of the surfaces of the bars forming the grids for gas-purifiers, and in bevelling the sides for about two-thirds of their depth, as shown in the engravings, in which fig. 1 is a plan of a part of a grid, and fig. 2 a section through A, B, fig. 1, C, C

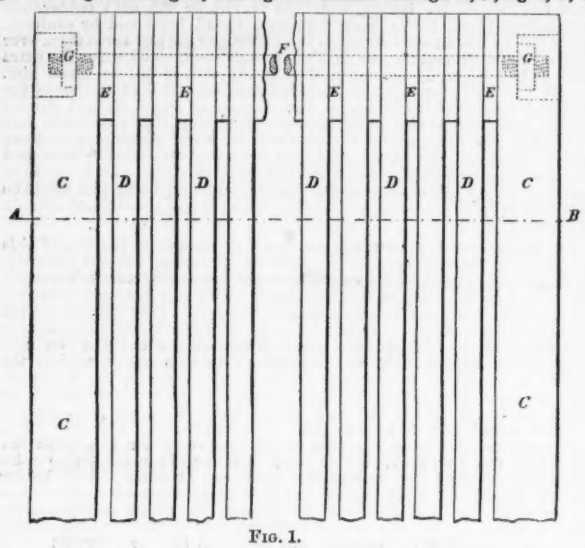

Fig. 1.

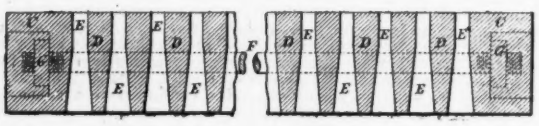

Fig. 2.

being the outside frame of the grid, and D, D the bars, having a section such as is shown in fig. 2. E, E are the distance pieces placed between the bars, and having corresponding bevels thereto, the whole being secured together by screwed tie-rods, F, and nuts, G, G.

1540.—Owen, S., Coventry, "*Improvements in and connected with modes and apparatus for opening and closing cocks and valves, especially applicable to the lighting and extinguishing of street and other lamps.*" Patent dated April 17, 1878.

The object of this invention is to apply machinery or apparatus to cocks and valves in such a manner, that when set or regulated in a certain definite manner, which may be indicated on an index or dial, it shall at a certain time open or close the cock or valve. Street and other lamps may be lighted by making use of a small branch or side pipe, which starts from below the cock or valve, and reaches to within a short distance of the main burner, and protected against the wind by means of a kind of lantern or envelope formed with one or more apertures below for the entry of air, and being at the top nearly closed, but there formed with one or more fine apertures through which the flame from the small burner can project, the top of the envelope being some little distance above the small burner. The cock or valve is opened and closed by wheels or clockwork operated by a spring or weight. The machinery is enclosed, and has a dial or index with one or more hands or pointers.

According to one arrangement, two wheels or sets of wheels are used, each connected to its hand on the same or on two separate dials marked with numbers like an ordinary clock dial, and each set of wheels is connected with appliances similar to ordinary hour-striking gear, and with an escapement or equivalent means for regulating. The striking gear is connected with the cock or valve, so that to whatever hour the one hand is set on the dial, the striking gear then set in motion shall open the cock or valve by means of ratchet gear or other suitable mechanism, and to whatever hour the other hand is set on the dial the same or corresponding striking gear then set in motion shall shut the cock or valve.

1542.—Lake, W. R., Southampton Buildings, London, "*Improved apparatus for regulating and controlling the pressure and quantity of gas supplied to gas-burners, and for other like purposes.*" A communication. Patent dated April 17, 1878.

Apparatus constructed according to this invention consists principally of a flexible, elastic, metallic box or vessel composed of two discs of thin corrugated sheet metal connected at their peripheries by a close joint. The box is enclosed or suspended within a chamber that connects with the supply-pipe and the burner tip, and through which the gas passes on its way to the burner. The interior of the box communicates with the outer atmosphere, and it is compressed by every increase of pressure of the gas, and expanded when the pressure is removed or diminished, and by such compression and expansion operates a valve or other suitable device for regulating the influx of gas into the chamber, and from thence to the burner, the quantity of gas admitted being thereby diminished when the pressure is increased, and increased when the pressure is diminished. The box is expanded by means of a spring, which counterbalances the pressure of the gas at any predetermined degree of pressure, and the tension or force of the spring is adjusted by means of a set screw operated from the outside of the apparatus, by which means the regulator can be set so as to begin to diminish the supply of gas to the chamber whenever the gas enters under a pressure greater than that for which it is set, and to increase the supply when the pressure begins to diminish.

1556.—Green, H., Preston, "*Improvements in apparatus for opening the supply of gas to burners, igniting the gas, and shutting off the supply.*" Patent dated April 17, 1878.

This invention relates to apparatus, operated to temporary augmentation of gas pressure in mains, for opening and closing the supply of gas to burners and for igniting gas. Apparatus for such purposes is described in the specification of a former patent granted to the present inventor and John Barrow, on the 2nd of September, 1873, No. 2889. The principal object of these improvements is by temporary augmentation of the gas pressure, when the quantity being drawn from the main is comparatively small, to effect the automatic opening or closing at a later period of the supply to burners; in other words, to secure an interval of time between the reduction of the augmented pressure in the main to the normal or ordinary working pressure and the opening or the closing (as the case may be) of the gas-way to the burner.

Among the uses of invention may be named its application to street-lamps, and in other cases where it may be desired to light up at a time when augmentation of the pressure in the mains to the extent necessary for turning the supply on to the burners would be attended with difficulty or inconvenience. The arrangement for this purpose is as follows:—In connection with the gas-main there is a gasholder of any suitable construction, between which and the main is an apparatus which will allow gas to flow to the holder from the main when the augmented pressure obtains in the main, and will at other times prevent such flow. By increasing the pressure in the main, so as to overcome the resistance of the controlling apparatus interposed between the main and the holder, the latter is charged and raised. On subsequent reduction of pressure communication with the main is closed by the action of the controlling apparatus. The contained gas is allowed to slowly escape or leak from the holder, which being cut off from the source of supply gradually descends, and in doing so brings or causes to be brought into operation at a proper time suitable parts, whereby gas is permitted to flow from the main to the burner, or the flow of gas to the burner is arrested, as the case may be.

The invention may be carried out in various forms.

In one arrangement the passage from main to burner is controlled by a valve on a counterweighted lever, which overbalances the valve. When closed, the valve is held down by a catch or projection, which moves automatically over the valve lever. The gasholder at its upper part carries a device, which at each ascent is caused to make a partial revolution into a position in which it is held by a ratchet, or click, or other suitable arrangement during the next descent. The position into which the device is moved is alternately one in which it will cause the valve to close. To open the valve the device carried by the gasholder in descending moves the catch or projection clear of the valve leaver, or causes this to be done by a crank arm. Assuming the valve to be open, which controls the flow of gas to the burner towards the completion of its downward movement, the device carried by the gasholder will, in descending, come in contact with the valve leaver, closing the valve, and the locking catch or projection will automatically move over the valve lever, locking the valve in the closed position. A second crank arm on the same axis as that already mentioned, may be connected by wire or otherwise with and operate apparatus, such as described in the former patent before referred to, for igniting gas at the burner, with or without the aid of a temporary gas-jet.

In another arrangement the valve governing the supply of gas to the burner closes by its own weight, and is opened by the device carried by the gasholder resting upon and pressing down its lever. In this case the supply of gas to the burner will be kept open so long as the device on the gasholder or other equivalent rests upon the lever, but when the holder rises, by the augmented pressure being turned on, the lever of the valve becomes liberated, the valve therefore discends and closes the supply of gas to burner.

Another method of carrying out the invention is by causing the gasholder to operate a rotating plug in a cock or valve, so as by the movements of the holder to turn on or off the gas supply as required.

APPLICATIONS FOR LETTERS PATENT.

4452.—Kauffmann, E., Red Lion Square, London, "Improvements in lamps." Oct. 31, 1879.

4485.—Wigham, J. R., Dublin, "Improvements in gas motor engines." Nov. 4, 1879.

4492.—Shaw, J., Cleckheaton, Yorks, "Improvements in gas motor engines." Nov. 4, 1879.

4501.—Robson, J., North Shields, Northumberland, "Improvements in gas-engines." Nov. 4, 1879.

4514.—Johnston, D., Glasgow, "A new or improved water or fluid meter, which is also applicable as a motive-power engine or pump." Nov. 5, 1879.

4519.—Ragot, G., Ixelles, Belgium, "Improvements in apparatus for carburetting air with naphtha or other hydrocarbons for use in lighting or heating." Nov. 5, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1832.—Fellowes, H. D., Bayswater, London, "Improvements in gas and lamp burners." May 8, 1879.

3245.—Abel, C. D., Chancery Lane, London, "Improvements in gas motor engines." A communication. Aug. 12, 1879.

PATENTS WHICH HAVE BECOME VCID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3894.—Young, W., Neilson, A., and Young, A., "Improvements in the destructive distillation of bituminous substances, and in the apparatus or means employed therefor." Oct. 9, 1876.

3939.—Barnes, J., "Improvements in water or other fluid meters or motors." Oct. 12, 1876.

3965.—Steel, J., "New or improved apparatus for purifying and condensing gas, and for extracting and collecting ammonia therefrom." Oct. 13, 1876.

4036.—Vandendriesche, A. E., "An improved gas-regulator designed for the purpose of being applied to burners of every description without altering the original appearance of the fittings." Oct. 19, 1876.

4106.—Leoni, S., "Improvements in the construction of boilers to be heated by gas." Oct. 24, 1876.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

3180.—Malam, A., "Improvements in the manufacture of illuminating gas, and in apparatus therefor." Oct. 26, 1872.

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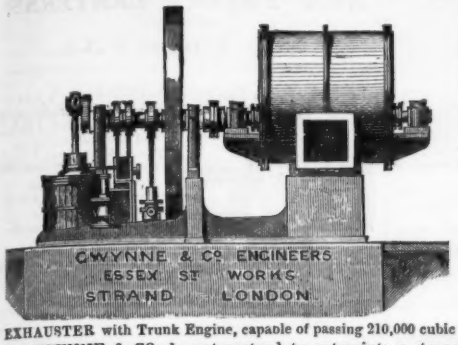

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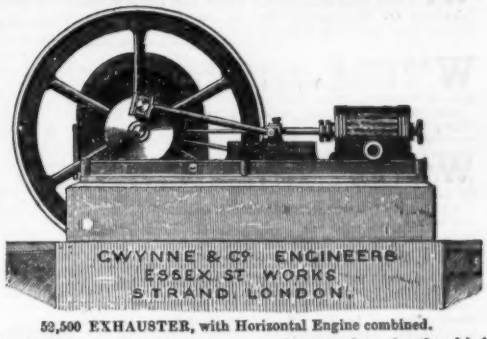

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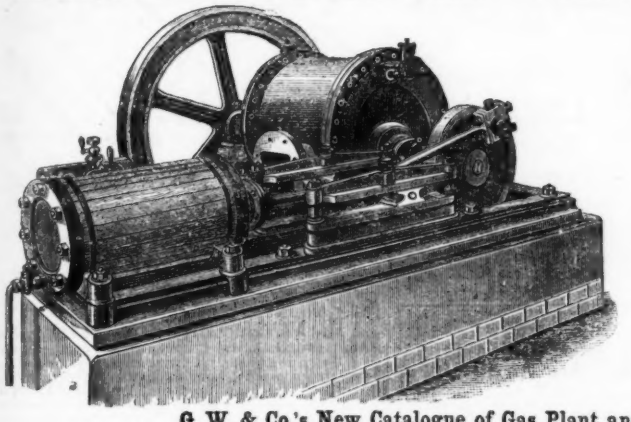

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Further information may be obtained of the Company's Manager (Mr. Greenfield), Hollacombe, Paignton, and tenders are to be sent to the undersigned, on or before the 25th of November inst.
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J. KITSON, Secretary.
Torquay, Nov. 4, 1879.

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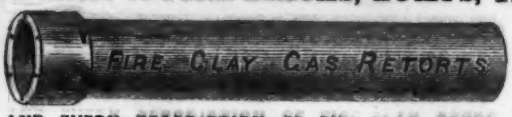

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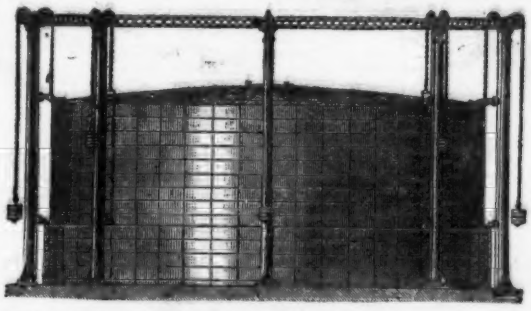

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John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

TROTTER, HAINES, & CORBETT,
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FIRE CLAY & BRICK WORKS,
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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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THE Tawd Vale Colliery Company, Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete analysis on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.
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REDUCTION IN PRICES.
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Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
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Mr. ROMANS has for upwards of 30 years been practically engaged in th Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.
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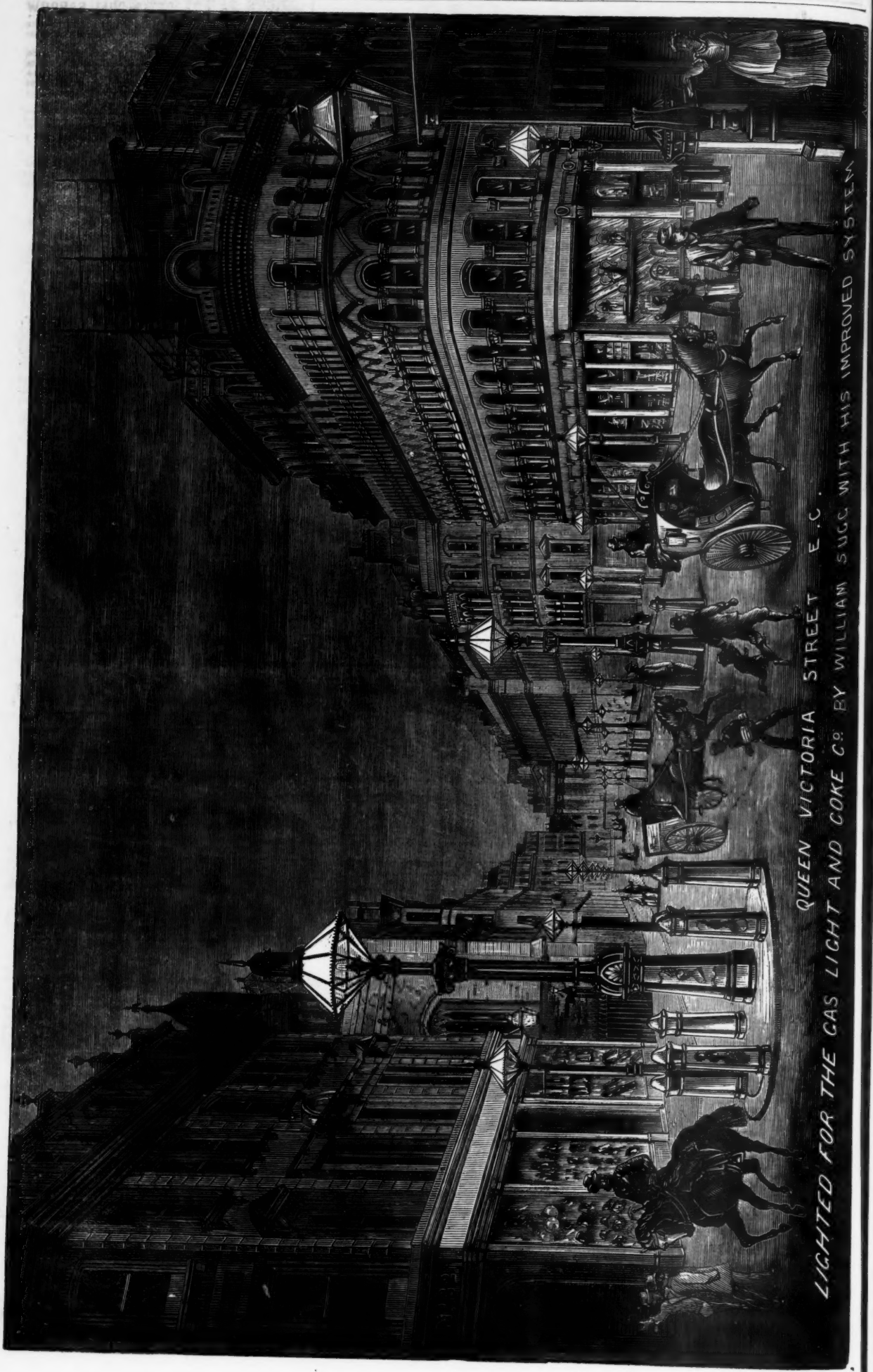
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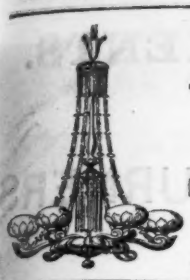

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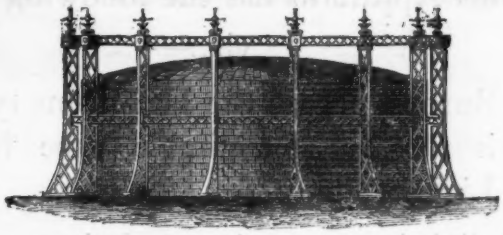

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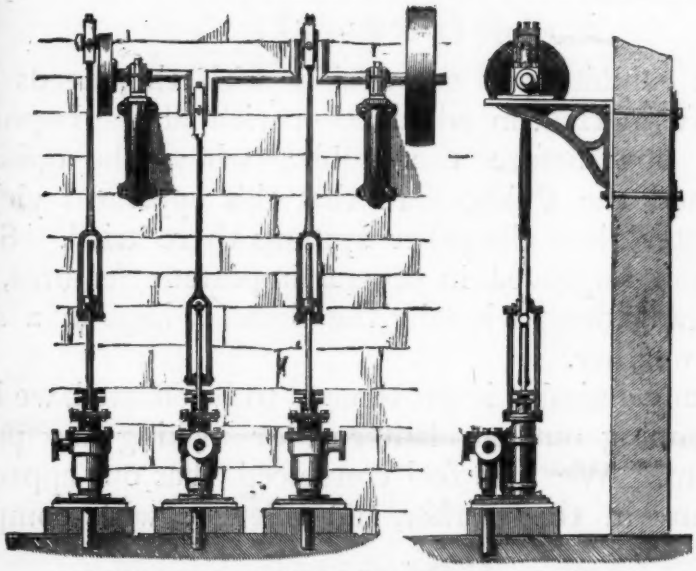

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For Water. For Tar. For Ammoniacal Liquor.

This Illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

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These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shornclife and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
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Imperial Stone.	Light Stone.
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A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

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PATENT LANTERNS & FLAT-FLAME BURNERS

Of 30 to 200 CANDLES POWER.

This Apparatus has the following merits, viz.:—

The Burners are of the Flat-Flame type, which is the only practicable type for Street-Lighting purposes.

Their lighting power is greatly in excess of Flat-Flame Burners made prior to the introduction of these, and, the up and the down light being taken into account, it is in excess of that yielded by any Burners, Flat-Flame or otherwise.

The flame in the lantern is remarkable for its steadiness, whiteness, and brilliancy.

The lantern is storm proof, its efficiency not being materially affected in a gale of wind.

It is practically shadowless, though the top light is allowed to pass freely to the upper parts of buildings, instead of being reflected, in the main, round the base of the lamp, as in some systems.

These Lamps were first exhibited in connection with the Leeds Gas Exhibition, in front of the Town Hall, in conjunction with all the improved systems of Street Lighting now before the public, when the opinions expressed by Gas Engineers and the Public were that this apparatus yielded more light and diffused it better than the other systems there tried. Since this Exhibition they have been improved in several important features, the principal of these being an arrangement whereby the flame is kept in a state of efficiency in the stormiest weather.

So long as we could see any desirable improvement to be effected, we have avoided, as far as possible, sending out our lanterns, or making any public announcement regarding them. We now feel convinced that our apparatus is nearer perfection than any in the market, and offer it with complete confidence.

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And every Description of Gas Apparatus.

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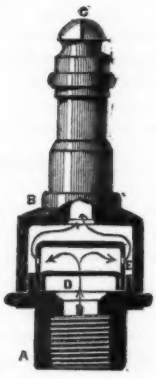

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These Regulators are made in various forms, adjusted to pass from One-half to Sixty cubic feet per hour.

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Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

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PORTABLE PIPE SCREWING

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For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

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Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

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WITH TAPER OR PARALLEL BARS,

MADE BY SPECIAL MACHINERY.

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

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WIGHAM'S PATENT GAS-BURNERS

FOR

STREET LIGHTING, &c., WHICH REQUIRE NO GLASS CHIMNEY.

Speaking of these burners, erected on the Thames Embankment, the Governor of The Gaslight and Coke Company, at the half-yearly meeting, Aug. 15, 1879, says:

"Any gentleman who may wish to see the light, may do so at the foot of Westminster Bridge, where it is in direct contiguity with the electric light, so that he will be able to judge for himself. There is a light there that completely excels the electric light in the intensity of its illumination, and in the scope of its diffusion. The lamps on Westminster Bridge are some of Mr. Wigham's."

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OF THE HIGHEST EXCELLENCE ONLY;

ROUND STATION-METERS,

ON CAST-IRON STANDS;

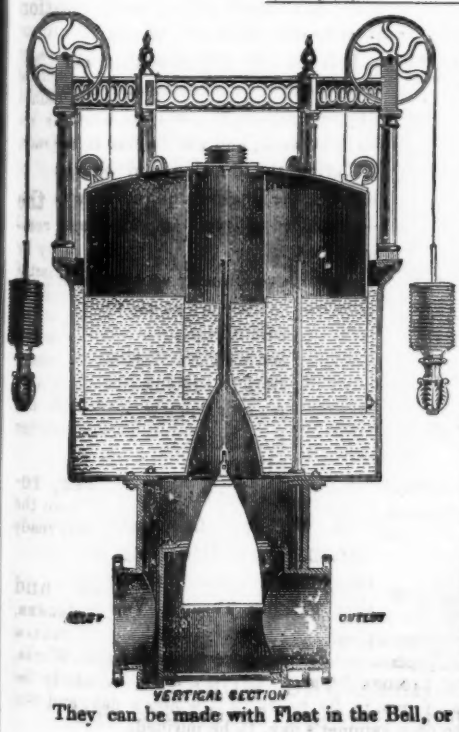
SQUARE STATION-METERS,

WITH PLANED JOINTS.

Messrs. Braddock beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

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Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

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The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. Silver Medal, Paris, 1878.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.

Post orders or cheques to be made payable to F. Sutton and Co., Manufacturing Chemists, Norwich, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.

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Prices on application.

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Yields 14,920 cubic feet of 40·92-candle gas per ton.

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12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

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Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND CO., 21, Lime Street, LONDON, E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

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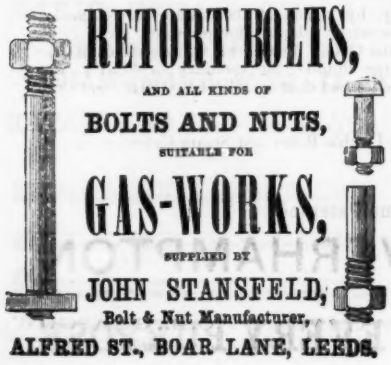

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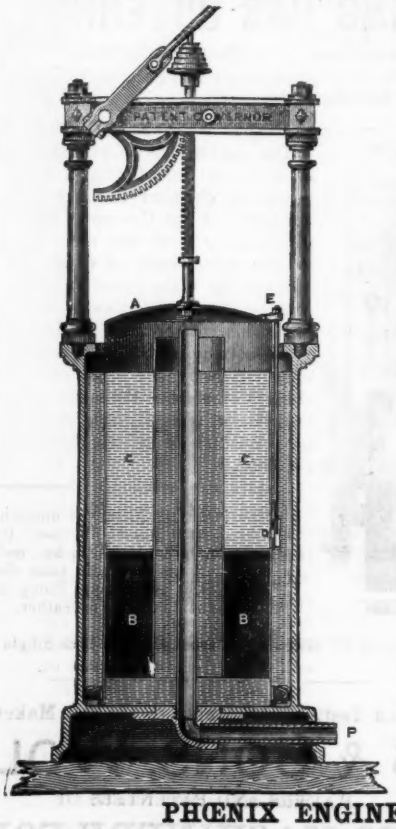

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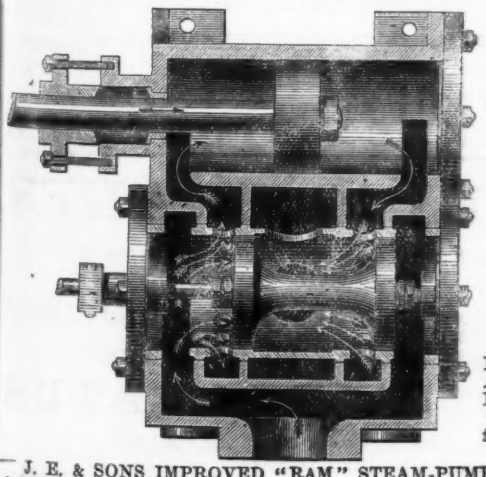

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